marconi instruments

# TK 1803

## CONTROL PANEL

## Instruction Manual

# Control Panel
# TK 1803

Code Nos. 51803-301N
51803-302L
51803-303J
51803-304F

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Any changes subsequent to the latest amendment state of the manual are included on inserted sheets coded C1, C2 etc.

# NOTES AND CAUTIONS

## ELECTRICAL SAFETY PRECAUTIONS

This equipment is protected in accordance with IEC Safety Class 1. It has been designed and tested according to IEC Publication 348, 'Safety Requirements for Electronic Measuring Apparatus', and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the equipment in a safe condition.

### Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by severe conditions of transport or storage, the equipment shall be made inoperative and be secured against any unintended operation.

### Removal of covers

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

Note that capacitors inside the equipment may still be charged when the equipment has been disconnected from the supply. Before carrying out any work inside the equipment, capacitors connected to high voltage points should be discharged; to discharge mains filter capacitors, if fitted, short together the L (live) and N (neutral) pins of the mains plug.

### Mains plug

The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension lead without protective conductor. Any interruption of the protective conductor inside or outside the equipment is likely to make the equipment dangerous.

### Fuses

Note that there is a supply fuse in both the live and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

To provide protection against breakdown of the supply lead, its connectors, and filter where fitted, an external supply fuse (e.g. fitted in the connecting plug) should be used in the live lead. The fuse should have a continuous rating not exceeding 6 A.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided.

WARNING : HANDLING HAZARDS

This equipment is formed from metal pressings and although every endeavour has been made to remove sharp points and edges care should be taken, particularly when servicing the equipment, to avoid minor cuts.

WARNING : TOXIC HAZARD

Many of the electronic components used in this equipment employ resins and other chemicals which give off toxic fumes on incineration. Appropriate precautions should therefore be taken in the disposal of these items.

Beryllia (beryllium oxide) is used in the construction of the following components in this equipment :

Voltage regulator IC1, heatsink-mounted in the mainframe

This material, when in the form of fine dust or vapour and inhaled into the lungs, can cause a respiratory disease. In its solid form, as used here, it can be handled quite safely although it is prudent to avoid handling conditions which promote dust formation by surface abrasion.

Because of this hazard you are advised to be very careful in removing and disposing of these components. Do not put them in the general industrial or domestic waste or despatch them by post. They must be separately and securely packed and clearly identified to show the nature of the hazard and then disposed of in a safe manner by an authorized toxic waste contractor.

Chapter 1

# GENERAL INFORMATION

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## INTRODUCTION

1. TK 1803 is an operator's control panel which enables direct operator control of GPIB Controllers TK 1801 or TK 1802. The control panel essentially consists of banks of switches plus indicators and a display to enable direct operator control. 12 of the 30 switches have built-in l.e.d.s which illuminate under program control. Certain switches are only capable of operation when the enable switch is simultaneously pressed, this is to prevent inadvertent operation. The action of some switches may be modified by the software program should there be a requirement for a non-standard control panel format. The 32 character alphanumeric display uses a 2-line dot matrix panel. Either line of the display may be individually updated without affecting the contents of the other. Characters are displayed in a 5 x 7 dot matrix format. The interface board for the panel is mounted in the GPIB controller. A key switch is used for the open/secure control, with the key being removable in both switch positions.

2. The operator control panel has its own self-contained power supply to enable it to be used at some distance from the main frame TK 1801. With the control panel mounted in front of the main frame, the mains switch not only controls internal power but also external power, via a relay, to a rear panel power outlet. This outlet enables power to be supplied to associated equipment.

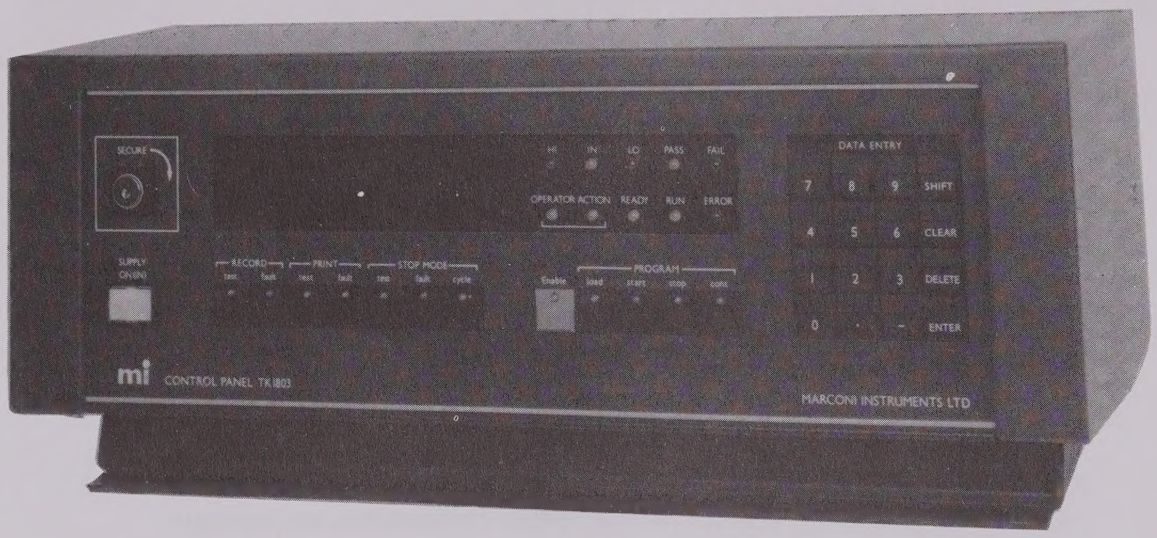


Fig. 1 Control Panel TK 1803 (-302L version)

PERFORMANCE DATA (versions 51803-301N, -303J, -304F)

3. General

The -301N version is designed for use with :-

a) TK 1802 Controller in which case it is used as a separately powered and separately fixed rack mounted unit.

b) TK 1801 Controller in which case it is physically bolted onto the front of the TK 1801 and the whole assembly becomes TK 1813.

A TK 1803 consists of a rack mounted assembly, an interface printed circuit board which plugs into a TK 1801 or TK 1802 and a 40-way ribbon cable assembly to interconnect the two.

The -303J version is designed for use with :-

a) TK 1802 Controller. It is a separately powered unit free-standing bench consisting of the unit itself, an interface printed circuit board which plugs into TK 1802 and a 40-way ribbon cable assembly to interconnect the two.

4. Facilities

Depending on the software in use with the TK 1801 or TK 1802, the operator can use the TK 1803 to communicate with the processor in the TK 1801 or TK 1802 via four sets of controls :-

a) A row of 7 black push-buttons located at the lower left of the front panel.

b) A row of 5 push-buttons located at the lower centre of the front panel (the

left-hand button is grey, the other four being black).

c) A two-position key switch located at the upper left of the front panel.

d) A block of 16 push-buttons in a 4 x 4 matrix at the right of the front panel. These are marked variously with the letters of the alphabet, numbers 0 to 9, fullstop, hyphen, 2 SHIFT controls, CLEAR, DELETE and ENTER.

The processor can communicate with the TK 1803 via four illuminated displays :-

a) A 32 character alpha-numeric display of the gas discharge type featuring 2 lines of 16 characters. Colour orange. Each character formed from a 7 x 5 dot matrix.
Standard characters available

ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑
!" # $ % & ' ( )* +, -./0123456789:;<=>?□
□ = Space

Display features separately addressable upper and lower lines and single character back space.

b) An array of 10 coloured annunciator lamps in two rows of 5 located upper centre of the front panel.
Top row left to right : red, green, red, green, red.
Bottom row left to right : amber, amber, amber, green, red and marked OPERATOR, ACTION, READY, RUN, ERROR respectively.

c) A row of 7 amber annunciator lamps associated one each with the row of 7 push-buttons described in a) above.

d) A row of 4 amber annunciator lamps associated one each with the four black buttons in the row of 5 described in (b) above. An amber lamp associated with the fifth grey button illuminates only when the button is pressed.

5. Controls

Power switch : Push-button illuminated white.
IN - ON; OUT - OFF.

Secure keyswitch :

2 position switch.
Key removable in both positions. Turning the key generates an interrupt signal to the processor in the TK 1801 or TK 1802. Status of the key switch can be interrogated at any time by the processor and is coded in bit 14 of the control status register as follows :-

Bit 14 asserted-key turned anti-clockwise.
Bit 14 non-asserted-key turned clockwise to secure.

Control push-button switches :

A row consisting of a group of 7 and a group of 5 push-button switches. Each switch incorporates an amber l.e.d. lamp. All buttons except one are black, the one being grey.

Each button is associated with a dedicated bit of the control status register as follows :-

a) A group of 7 reading from right to left associated with bits 0 to 6 respectively.

b) A group of 5.

(i) Four black buttons reading from right to left associated with bits 10 to 13 respectively.

(ii) A grey button is associated with bit 15.

Pressing any button causes the corresponding bit to be asserted except for the grey button. For the grey button to assert bit 15 it is necessary to first press the grey button and then, holding the grey button depressed, press any of the black buttons.

When the grey button is pressed its associated amber lamp lights and extinguishes when the button is released.

The remaining lamps associated with the black buttons are lit and extinguished independently of button operation and under software control. Pressing any black button generates an interrupt signal to the processor in the TK 1801 or TK 1802. The processor determines which button was pressed by interrogating the control status register. Interrogation reinitializes the register in readiness for another button being pressed. Pressing further buttons has no effect until approximately 70 ms after the previous button has been released.

4 x 4 keypad switches :

16 push-button switches in a 4 x 4 matrix. Each button is associated with a dedicated bit of the keypad status register as follows :-

Lower right button is associated with bit 0. Then reading upwards in columns and progressing column by column to the left the remaining bits 1 to 15 are associated in that order with buttons read : finishing with the top left button and bit 15.
Each button is black.

| Button no. | Marking |
|---|---|
| 0 | ENTER (w), Y(b), Z(o) |
| 1 | DELETE (w), CLEAR (o) |
| 2 | SHIFT (o) |
| 3 | SHIFT (b) |
| 4 | - (w), W(b), X(o) |
| 5 | 3 (w), Q(b), R(o) |
| 6 | 6 (w), K(b), L(o) |
| 7 | 9 (w), E(b), F(o) |
| 8 | . (w), U(b), V(o) |
| 9 | 2 (w), O(b), P(o) |
| 10 | 5 (w), I(b), J(o) |
| 11 | 8 (w), C(b), D(o) |
| 12 | 0 (w), S(b), T(o) |
| 13 | 1 (w), M(b), N(o) |
| 14 | 4 (w), G(b), H(o) |
| 15 | 7 (w), A(b), B(o) |

(w) = white, (o) = orange, (b) = blue

Pressing keypad button generates an interrupt signal to the processor in the TK 1801 or TK 1802. The processor determines which button was pressed by interrogating the keypad status register. Interrogation reinitializes the register in readiness for another button being pressed. Pressing further keypad buttons has no effect until approximately 70 ms after the previous keypad button has been released.

6. Annunciators

An array of 10 coloured l.e.d. lamps arranged in two rows of 5.
Lamps can be lit or extinguished in any combination under software control from the processor in the TK 1801 or TK 1802. Each lamp is associated with a dedicated bit in the annunciator control register as follows :-

Lower right lamp is associated with bit 0. Then reading right to left first on the bottom row then the top row the lamps are associated with bits 0 to 9 respectively.

| Lamp no. | Marking |
|---|---|
| 0 | ERROR |
| 1 | RUN |
| 2 | READY |
| 3 | OPERATOR ACTION |
| 4 | |
| 5 | 5 |
| 6 | 4 |
| 7 | 3 |
| 8 | 2 |
| 9 | 1 |

7. Lamps

All black control buttons are fitted with lamps as described under Control Push Button switches. Each lamp is associated with a dedicated bit in the button lamp control register, bit number allocation being the same as for the associated buttons and the control status register.

8. Display

The processor in the TK 1801 or TK 1802 can, under software control, write directly to the display one character at a time. Characters appear in order starting at the top left as in normal writing and progressing on to the bottom line when the top line is full. When the bottom line is full characters start to overwrite from the top left again.

Control signals can be used to :-

a) Restart writing at start of top line.

b) Restart writing at start of bottom line.

c) Backspace one or more positions before resuming writing.

Characters are written by the following octal codes :-

| | | | |
|---|---|---|---|
| @-00 | P-20 | □-40 | 0-60 |
| A-01 | Q-21 | !-41 | 1-61 |
| B-02 | R-22 | "-42 | 2-62 |
| C-03 | S-23 | #-43 | 3-63 |
| D-04 | T-24 | $-44 | 4-64 |
| E-05 | U-25 | %-45 | 5-65 |
| F-06 | V-26 | &-46 | 6-66 |
| G-07 | W-27 | '-47 | 7-67 |
| H-10 | X-30 | (-50 | 8-70 |
| I-11 | Y-31 | )-51 | 9-71 |
| J-12 | Z-32 | *-52 | :-72 |
| K-13 | [-33 | +-53 | ;-73 |
| L-14 | \-34 | ,-54 | <-74 |
| M=15 | ]-35 | --55 | =-75 |
| N=16 | ↑-36 | .-56 | >-76 |
| O-17 | □-37 | /-57 | ?-77 |

NB □ = Space

9. Addressing & registers :

TK 1803 has 2 consecutive addresses (refer to details of LSI-11 bus addressing in TK 1801 or TK 1802). An eight-section switch and two wire links on the interface board enable any pair of addresses of the form 1XXXX0 and 1XXXX2 in the range 160000 to 177772 to be selected. The TK 1803 has one interrupt vector (refer to details of LSI-11 interrupt architecture in TK 1801 or TK 1802). A six-section switch on the interface board enables any interrupt vector of the form XX0 in the range 000 to 770 to be selected. The lower address is that of the control register. Reading from this enables the processor in TK 1801 or TK 1802 to determine the status of the TK 1803. Writing to this register determines :-

a) Whether information subsequently read from the higher address is :-

(i) the control status register

(ii) the keypad status register.

b) Whether information subsequently written to the higher address is used :-

(i) To control annunciators
(ii) To control button lamps
(iii) To control the display.

10. External

Via a 14-way DIL socket on the interface board the following facilities are available :-

(1) Nominal +5 V supply for external annunciators. 50 mA max.

(2) Parallel drives for annunciators 3 and 4. Sinking 12 mA max.

(3) Drives for independent annunciators 10 and 11. Sinking 12 mA max.

(4) 0 V (ground) reference rail.

(5) Lines for independent push-button switches numbers 7, 8 and 9. Contact closure to ground switching 12 mA causes interrupt to processor in TK 1801 or TK 1802.

(6) Lines in parallel with any 3 of the 4 black push-button switches in the group of 5. Contact closure to ground switching 12 mA causes interrupt to processor in TK 1801 or TK 1802. Selection of which 3 by wire links on board internal to TK 1803.

A 40-way plug is located on the rear panel to attach one end of the ribbon cable to the interface board.

11. Safety regulations : Complies with IEC 348 and BS 4743 safety requirements.

12. Radio frequency interference : Conforms to the requirements of IEC directive 76/889 as to limits of r.f. interference.

13. Limit range of operation

Temperature : $0^{o}$ to $55^{o}$C.

14. Conditions of storage and transport

Temperature : $-40^{o}$C to $+70^{o}$C.

Humidity : Up to 90% relative humidity.

Altitude : Up to 2500 m (pressurized freight at 25kPa differential, i.e. 3.7 lbf/in$^2$.

15. Supply

| | |
|---|---|
| Nominal mains voltage range : | 95 to 130 or 190 to 264 V a.c. at 45 to 65 Hz. |
| Fuses : | 1.25A (230V)or 2.5A (115V) time-lag in each line. Mains transformer 250 mA. |
| Consumption : | Approx. 35 VA plus up to 215 VA max. via supply outlet. |
| Auxiliary supply outlet : | Socket outlet on rear panel controlled by SUPPLY switch on front panel. Rating 215 VA max. |
| Mains input | Greater than 100 MΩ at 500 V a.c. Flash test at 1.5 kV. |
| Initialization : | At switch on all annunciators, button lamps and the display are off. No other block initialization provided. |

16. Dimensions and weight

Height : 133 mm (5.2 in)
Width : 485 mm (19 in)
Depth : 200 mm (7.9 in)
Weight : 6.3 kg (13.9 lb), -301N version
13 kg (28.7 lb), -303J version

PERFORMANCE DATA (Version 51803-302L)

17. General

The -302L version is designed for use with :-

(a) System 80 series automatic test equipments.

It is a tabletop free standing instrument, ergonomically and visually compatible with other System 80 units. Software supplied with System 80 is necessary for its correct operation.

18. Facilities

The operator uses the TK 1803 to communicate with the System 80 controller via 4 sets of controls.

(a) a row of 7 push-buttons located at the lower left of the front panel. These are grouped from left to right as follows.

(i) two buttons to select the results recording mode. Either all results or only out of limits results may be selected for recording on floppy disk.

(ii) two buttons to select the results print-out mode. Either all results or only out of limits results may be selected for print-out.

(iii) three push-buttons to select the halt mode. The system can be programmed to stop after each measurement, to stop when an out-of-limits result occurs or to repetitively make the same measurement.

(b) a row of 5 push-buttons located at the lower centre of the front panel. The left hand button marked ENABLE must be pressed first and held pressed before any of the other four are pressed. This is a safeguard against accidental pressing of any button. The function of the other four buttons is for program control; from left to right to load a program, start running the program, stop the program, and continue the program after a pause or halt [see (a) (iii)].

(c) a two position keyswitch located at the upper left of the front panel. Turned to the SECURE position this control can be used to disable other controls. Key is removable in both positions.

(d) a block of 16 push-buttons in a 4 x 4 matrix at the right of the front panel. These are marked variously with the letters of the alphabet, numbers 0 to 9, fullstop, hyphen, 2 SHIFT controls, CLEAR, DELETE and ENTER.

The controller can communicate with the operator via four illuminated displays on TK 1803.

(a) a 32 character alpha-numeric display of the gas discharge type featuring 2 lines of 16 characters.
Colour orange.
Each character formed from a 7 x 5 dot matrix.

Standard characters available
ABCDEFGHIJKLMNOPQRSTUVWXYZ [\]↑
!"#&%'()*+,-./0123456789:;<=>?
Display features separately addressable upper and lower lines and single character backspace.

(b) an array of 10 coloured annunciator lamps in two rows of 5 located upper centre of the front panel. Top row left to right red, green, red, green, red and marked high, in low, pass, fail respectively.

Bottom row left to right amber, amber amber, green, red and marked OPERATOR, ACTION, READY, RUN, ERROR, respectively.

(c) a row of 7 amber annunciator lamps associated one each with the row of 7 push buttons previously described. Lamp lights to show controller has acknowledged button being pressed.

(d) a row of 4 amber annunciator lamps associated one each with the four black buttons in the row of 5 described in 1(b).
An amber lamp associated with the fifth ENABLE button illuminated only when the button is pressed.

19. Controls

| | |
|---|---|
| Power switch : | Push-button illuminated white.<br>IN-ON; OUT-OFF. |
| Secure keyswitch : | 2 position switch.<br>Key removable in both positions. |
| Control push-button switches : | A row consisting of a group of 7 and a group of 5 push-button switches. Each switch incorporates an amber l.e.d. lamp. All buttons except one are black, the one being grey. |
| 4 x 4 keypad switches : | 16 push-button switches in a 4 x 4 matrix. There is approximately 70 ms delay after releasing one button before another one can be usefully pressed. |

20. Annunciators — An array of 10 coloured l.e.d. lamps arranged in two rows of 5. All black control buttons are fitted with lamps as described under Control push-button switches.

21. Display — 32 characters in two rows of 16 each formed from a 7 x 5 dot matrix, size 8.3 mm x 5.7 mm. See Facilities for character set.

22. External — Via a 14-way DIL socket on the interface board the following facilities are available :-

(1) +5 V supply for external annunciators. 50 mA max.

(2) Parallel drives for 'operation' annunciators.
Sinking 12 mA max.

(3) Drives for two independent annunciators.
Sinking 12 mA max.

(4) 0 V (ground) reference rail.

(5) Lines for three independent push-button switches. Contact closure to ground switching 12 mA causes interrupt to TK 1802 controller.

(6) Lines in parallel with any 3 of the 4 black push-button switches in the group of 5. Contact closure to ground switching 12 mA causes interrupt to TK 1802 controller. Selection of which 3 by wire links on board internal to TK 1803.

A 40-way plug is located on the rear panel to attach one end of the ribbon cable to the interface.

23. Safety regulations : Complies with IEC 348 and BS 4743 safety requirements.

24. Radio frequency interference : Conforms to the requirements of IEC directive 76/889 as to limits of r.f. interference.

25. Limit range of operation

Temperature : 0° to 55°C.

26. Conditions of storage and transport

Temperature : -40°C to +70°C.

Humidity : Up to 90% relative humidity.

Altitude : Up to 2500 m (pressurized freight at 25 kPa differential (i.e. 3.7 lbf/in$^2$).

27. Supply

Nominal mains voltage range : 95 to 130 or 190 to 264 V a.c. at 45 to 65 Hz.

Fuses : 1.25 A (230 V) or 2.5 A (115 V) time-lag in each line. Mains transformer 250 mA.

Consumption : Approx. 35 VA plus up to 215 VA max. via supply outlet.

| | |
|---|---|
| Auxiliary supply outlet : | Socket outlet on rear panel controlled by SUPPLY switch on front panel. Rating 215 VA max. |
| Mains input : | Greater than 100 MΩ at 500 V a.c. Flash test at 1.5 kV. |
| Initialization : | At switch on all annunciators, button lamps and the display are off. No other block initialization provided. |

28. Dimensions and weight :

Height : 133 mm (5.2 in)
Width : 485 mm (19 in)
Depth : 200 mm (7.9 in)
Weight : 13 kg (28.7 lb)

## ALTERNATIVE VERSIONS

29. The following alternative versions of the panel are available :-

| | |
|---|---|
| 51803-301N | General purpose, rack mounting version. |
| 51803-302L | System 80, bench mounting version. |
| 51803-303J | General purpose, bench mounting version. |
| 51803-304F | System 80X, rack mounting version. |

## ACCESSORIES

30. Supplied accessories

Panel interface board (includes 40-way interface cable. 43129-366N) AC8, 46883-453N.
Extender board AC9, 46883-454L.
Mains lead, 43129-003W.
Plug, 23423-156W.
Instruction Manual H 51803-900P, 46881-379J.

Chapter 2

# INSTALLATION

CONTENTS

Para.
1 Unpacking and repacking
3 Power supplies
5 Safety testing
6 External cable connection
7 Rack mounting instructions

## UNPACKING AND REPACKING

1. Retain the container, packing materials and the packing instruction note (if included) in case it is necessary to reship the instrument.

2. If the instrument is to be returned for servicing attach a label indicating the service required, type or model number (on rear label), serial number and your return address. Pack the instrument in accordance with the general instructions below or with the more detailed information in the packing instruction note.

(1) Place a pad in the bottom of the container.

(2) Place pads in the front and rear ends of the container with the plywood load spreader(s) facing inwards.

(3) Put the polythene cover over the instrument and place it in the container with the front handles and rear projections (where applicable) against the plywood load spreaders.

(4) Place pads in the two sides of the container with cushioning facing inwards.

(5) Place the top pad in position.

(6) Wrap the container in waterproof paper and secure with adhesive tape.

(7) Mark the package FRAGILE to encourage careful handling.

Note ...

If the original container or materials are not available, use a strong double-wall carton packed with a 7 to 10 cm layer of shock absorbing material around all sides of the instrument to hold it firmly. Protect the front panel controls with a plywood or cardboard load spreader; if the rear panel has guard plates or other projections a rear load spreader is also advisable.

## POWER SUPPLIES

3. The control panel operates on 95 to 130 V and 190 to 264 V a.c. mains, 50 or 60 Hz. Before switching on, ensure that the rear panel 115/230 V voltage range selector is set to the correct position and that the correct value supply fuses are fitted. To change the mains voltage setting, reverse the L-shaped locking plate after setting the slider switch to its alternative position. For the 230 V range the required fuse is 1.25 A , for the 115 V range the correct value is 2.5A. These also protect the auxiliary SUPPLY OUT socket. Mains transformer fuse is 250 mA.

4. The supply lead is a cable fitted at one end with a female plug which connects to the instrument. When fitting a suitable supply plug to the other end note that the wires are colour coded as follows :-

| | | |
|---|---|---|
| Earth (ground) | - | Green/Yellow |
| Neutral | - | Blue |
| Line (phase) | - | Brown |

(Version -302L is already fitted with a supply plug)

### Safety testing

5. Where safety tests on the mains input circuit are required, the following procedures can be applied. These comply with BS 4743 and IEC Publication 348. Tests are to be carried out as follows and in the order given, under ambient conditions, to ensure that mains input circuit components and wiring (including earthing) are safe.

(1) Earth lead continuity test from any part of the metal frame to the bared end of the flexible lead for the earth pin of the user's mains plug. Preferably a heavy current (about 25 A) should be applied for not more than 5 seconds.

Test limit : not greater than 0.5 Ω.

(2) 500 V d.c. insulation test from the mains circuit to earth.

Test limit : not less than 2 MΩ.

## EXTERNAL CABLE CONNECTION

6. Control Panel TK 1803 is connected via a 40-way ribbon cable to the panel interface board mounted in the controller. When fitting the cable ensure that it is fitted correctly i.e., cable contacts 1 to contacts 1 on the control panel and

interface board connectors. These contacts are identified by a moulded arrow. After connection clamp the cable by means of the adjacent cable clamp.

RACK MOUNTING INSTRUCTIONS

7. Those instruments supplied in rack-mounting form need only the addition of the supplied rack mounting brackets. To fit the brackets proceed as follows :-

(1) Fit the brackets in the recesses for the front handles and secure by fitting the M4 screws provided into the tapped holes.

(2) The instrument should be additionally supported in the rack by means of shelves. Normal care should be exercised when withdrawing the instrument from the shelves.

Chapter 3

# OPERATION

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2 Front panel
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4 External switch patching
6 Interface configuration

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4 Interface board AC8 showing switch and link locations ... ... 6

## GENERAL

1. This chapter is intended as a general operating guide and does not refer to specific versions of the instrument. Some versions of the control panel perform specific functions (such as Autotest System 80 for Version -302L) and these have fully marked front panels. For these versions refer to the appropriate system operating manual for fully detailed operating instructions.

## CONTROLS AND CONNECTORS

### Front panel

2. The front panel controls shown in Fig. 1 are as follows :-

(1) SUPPLY ON (IN) switch. Switch ON (button IN) in order to apply power to the control panel. This switch also controls the power to Controller TK 1801 via the auxiliary SUPPLY OUT socket (13) but not to Controller TK 1802 which has its own supply switch.

(2) SECURE keyswitch. May be used to permit or deny operator intervention. For this purpose, when the key is in the open (vertical) position the operation of various switches is enabled following which the selection may be locked out by turning the key clockwise to the secure position. The key is removable in either position. In the vertical position bit 14 of the control status register is asserted.

(3) Display. Used for the display of up to 32 characters arranged in two lines of 16 characters. Each character is formed by a 7 x 5 dot matrix. The alpha-numeric characters (not lower case) displayed are detailed under Performance Data in Chap. 1. The display features separately addressable upper and lower lines and single character backspace.

(4) 10 variously coloured annunciator lamps operating under software control.

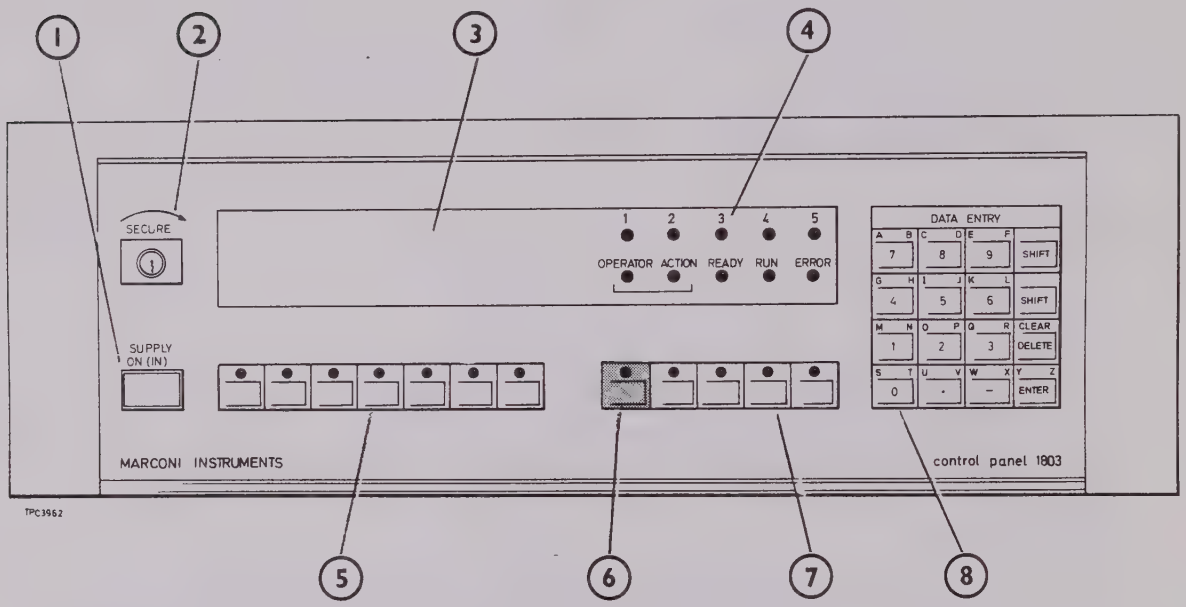


Fig. 1 Front panel controls, -301N, -303J and -304F versions.

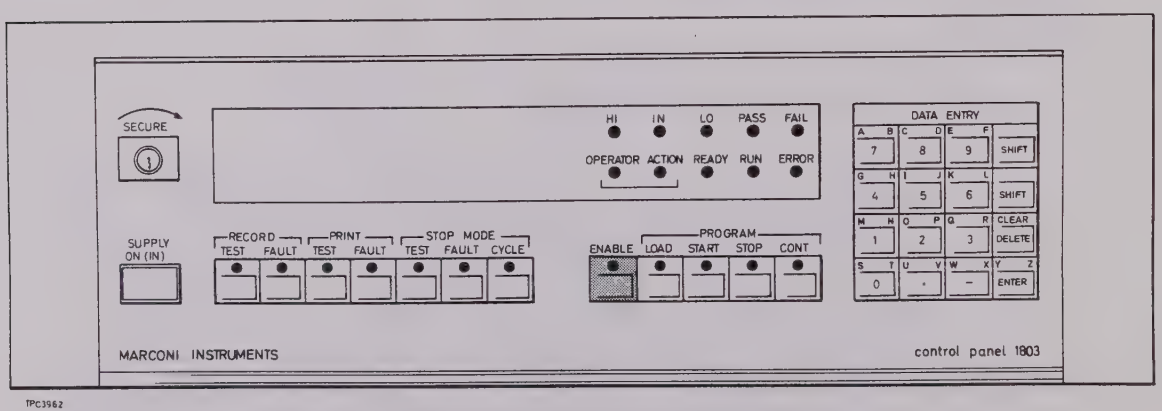


Fig. 2 Front panel controls, -302L version.

(5) 7 push-button switches each with an amber annunciator lamp. Each switch is dedicated (reading from right to left) to bits 0 to 6 of the control status register. The lamps illuminate under software control. The switches may be used in conjunction with (6).

(6) Switch and lamp. Pressing the push-button causes the associated amber lamp to illuminate which then extinguishes when the button is released. The switch may be used as a safeguard to enable any of the switches (5) or (7). To operate press and hold this switch then press the required switch. This action causes the switch to assert bit 15 of the control status register.

(7) 4 push-button switches each with an amber annunciator . Each switch is dedicated (reading from right to left) to bits 10 to 13 respectively of the control status register. May be operated in conjunction with (6).

(8) DATA ENTRY keypad. 16 push-button switches arranged in a 4 x 4 matrix and used for data entry. Each switch is dedicated to a bit in the keypad status register as shown :-

| | | | |
|---|---|---|---|
| 15 | 11 | 7 | 3 |
| 14 | 10 | 6 | 2 |
| 13 | 9 | 5 | 1 |
| 12 | 8 | 4 | 0 |

Rear panel

3. The rear panel controls and connectors shown in Fig. 3 are as follows :-

(9) Supply voltage selector. 230 V position for 190-264 V, 115 V position for 95 to 130 V. To change the range set the switch to its alternative position after reversing the locking plate.

(10) Supply fuses. 1.25 A for 190-264 V range, 2.5 A for 95-130 V range.

(11) CONTROLLER INTERFACE CONNECTOR and clamp. Connector for 40-way ribbon cable assembly to interface board which plugs into Controller TK 1801 or TK 1802.

(12) SUPPLY IN socket. 3-pin a.c. supply input connector.

(13) SUPPLY OUT socket. Auxiliary output socket. Controlled by (1).

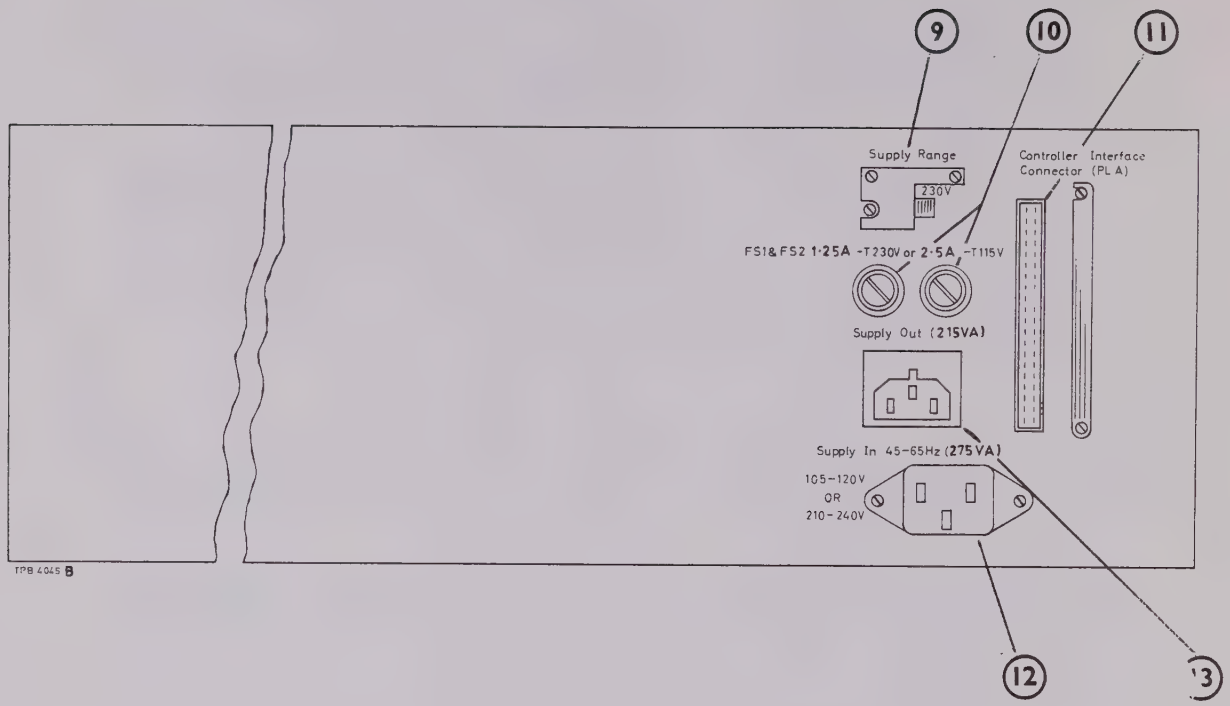


Fig. 3 Rear panel controls and connectors.

## EXTERNAL SWITCH PATCHING

4. Provision is made to enable up to 3 external switches (contact closure 0 V) to parallel certain of the control buttons e.g. to enable remote operation. By means of wire links the switches may be patched on mother board AC1 to assert bits 10 to 13 of the control word.

5. To use the facility, the external switch is connected to socket SKGA on AC8 and a wire link connected between any one of contacts Z1 to Z3 and any one of contacts SC10 to SC13 on AC1 (see Table 1). For example, with Z3 patched to SC11, a switch connected between contacts 6 (earth) and 10 of SKGA on AC8 may be used to stop program operation remotely (Version -302L).

TABLE 1 EXTERNAL SWITCH PATCHING

| EXT. SWITCH | AC8 SKGA CONTACT | AC1 PATCHING | | SWITCHES PARALLELLED | |
|---|---|---|---|---|---|
| 1 | 2 | Z1 | SC10 | S10 | (CONT)* |
| | | | SC11 | S11 | (STOP) |
| 2 | 3 | Z2 | SC12 | S12 | (START) |
| 3 | 10 | Z3 | SC13 | S13 | (LOAD) |

*Markings as for -302L Version.

## INTERFACE CONFIGURATION

6. Interface AC8 is a dual module board which is inserted in the TK 1802 boardframe. As shown in Fig. 4 it is configured by switches to select an interrupt vector and by switches and links to form the board address.

### Addressing

7. The LSI-11 address, in the range 160 000 to 177 772, is set on 8-switch bank SA for bits 3 to 10 and on two wire links for bits 11 and 12. For logical '1' the appropriate switch is set to OPEN. For logical '1' the wire links are set as shown in Fig. 4. The links and switches select standard addresses 176 750, 176 752 octal when set as follows :-

| LINK | | SWITCH | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 |
| '1' | '1' | '1' | '0' | '1' | '1' | '1' | '1' | '0' | '1' |

Note that these settings effectively discard the first and last 3 bits of the address.

### Interrupt vectors

8. The interrupt vector, in the range 0 to 770 is set on 6-switch bank SB for bits 3 to 8. For logical '1' the appropriate switch is set to OPEN. The switches select standard vector 140 octal when set as follows :-

| 8 | 7 | 6 | 5 | 4 | 3 |
|---|---|---|---|---|---|
| '0' | '0' | '1' | '1' | '0' | '0' |

Note that these settings effectively discard the last 3 bits of the vector.

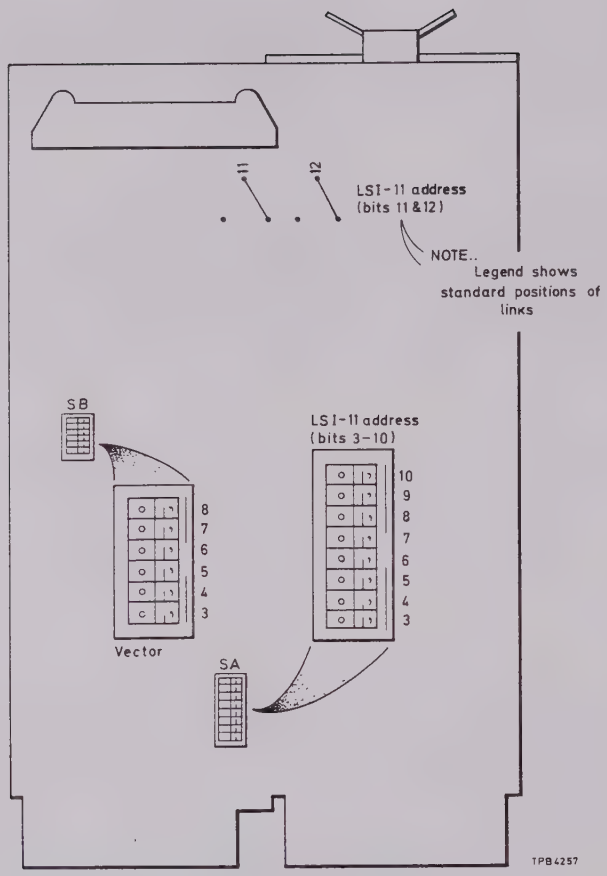


Fig. 4 Interface board AC8 showing switch and link locations.

Chapter 4

# TECHNICAL DESCRIPTION

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## INTRODUCTION

1. The following description should be read in conjunction with the control panel operation summary Fig. 1 and the circuit diagrams in Chap. 7. The circuits are summarized in paras. 2 to 6 and then each board is described in paras. 7 to 37.

## CIRCUIT SUMMARY

### Control panel

2. Essentially, the function of the control panel is to send switch commands to the microcomputer in the TK 1802 GPIB Controller and to receive processor messages which operate the display and cause the lamps to illuminate. Messages pass between Control Panel TK 1803 and interface board AC8 in the TK 1802 backplane via the P bus, while messages between AC8 and the CPU pass via the LSI-11 bus (see Fig. 1).

### Writing data

3. To set up initial conditions for writing data, a control word is sent by the processor to a control and status register on board AC8. The resulting function selection signals are sent via the P bus and the transceivers on AC3 to board AC4. Here the signals are decoded either to operate the display e.g. backspace, start new line, or else sent to AC5 and AC6 to enable the annunciators or button lamps. The processor follows the control word with a data word which either defines the character to be displayed or causes a particular lamp combination to illuminate.

### Reading data

4. To read data from the control panel when a keypad switch, control button or key switch is operated, the sequence of events is broadly as follows : Provided interrupts are enabled in both the processor and control panel, an interrupt is generated to the processor. When the processor services the interrupt a vector is sent to the processor to access the service routine held in the program memory. The contents of the control and status register are then changed to enable the switch data to be read by the processor after which the action demanded by operating the switch is carried out.

## Power supplies

Circuit diagram : Chap. 7, Fig. 1

5. The a.c. supply from the SUPPLY IN connector and filter is fed via fuses FS1, FS2 to the SUPPLY switch SAA and then either to the auxiliary SUPPLY OUT connector or to mains transformer T1. The two halves of T1 primary are connected in series for 230 V and in parallel for 115 V according to the position of the SUPPLY RANGE selector. There are three secondary windings which feed to power supply board AC7. The 10 V secondary feeds to the +5 V regulator supplying board and display logic. The 17 V secondary provides -12 V for the display and to illuminate the SUPPLY lamp while the 165 V secondary provides the +147 V drive for the alphanumeric display.

## AC1 - MOTHER BOARD

Circuit diagram : Chap. 7, Fig. 2

6. This board is used to interconnect the plug-in printed circuit boards.

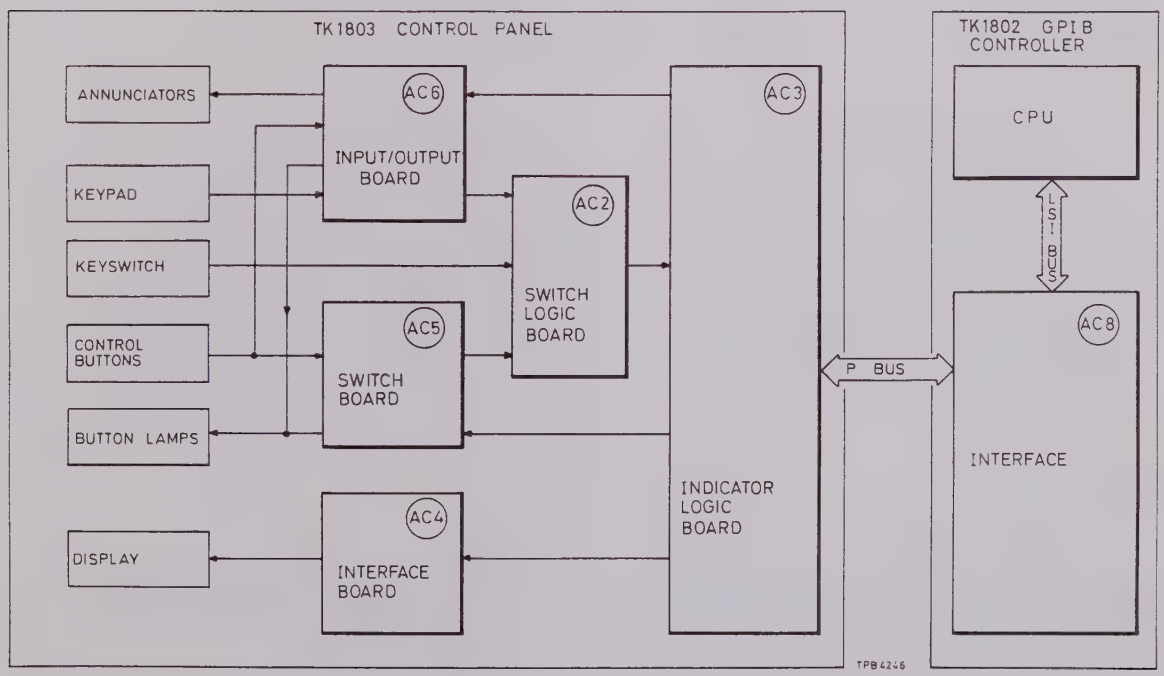


Fig. 1 Control panel operation summary

## AC2 - SWITCH LOGIC BOARD

Circuit diagram : Chap. 7, Fig. 3

7. When a control button or a keypad switch is pressed, a low output results from AC5 or AC6 which is used as a set signal to one of the $\overline{R}$-$\overline{S}$ latches IC1, 3, 5, 7, 9 or 11 on this board. The key switch either sets or resets an IC1 latch depending upon which way the switch is turned. Any change in the state of this latch produces an EK RQS signal on board AC4 and this signal is returned to board AC2 to the 'OR' function of IC14 as described below. Latches are reset by $\overline{\text{RESET}}$ CHAR (for keypad switches), or $\overline{\text{RESET}}$ BUT (for the keyswitch or control buttons). Latch outputs are taken to the processor via tristate buffers; IC4 and IC6 when enabled by $\overline{\text{BUT}}$ or IC8 and IC12 when enabled by $\overline{\text{CHAR}}$. The operation of any switch is detected by NOR gate IC2, IC10 or IC13 together with IC14 (effectively a dual OR gate to the low input signals). This results in a BUT INT or CHAR INT signal which causes a processor interrupt to enable the switch request to be serviced. Overall switch operation is summarized in Fig. 2 (for details see under relevant board headings).

## AC3 - INDICATOR LOGIC BOARD

Circuit diagram : Chap. 7, Fig. 4

### Bus input data

8. Input data for display or l.e.d. illumination purposes are fed from the microcomputer via IC8 on $\overline{\text{PIO}}$ lines 0 to 15 to transceiver ICs 13, 9, 10 and 11. From here the data are sent to 1 of 3 destinations. One path, from $\overline{\text{PIO}}$ lines 0 to 5, is via AC4 to the alphanumeric display via PLBB outputs B1 to B6. For the other two paths the data are fed in parallel to four multiple D-type latches. When clocked by CLOCK AN the data are routed via IC1 and IC3 to the annunciators on board AC6, and when clocked by CLOCK L the data are routed via IC5 and IC6 to the button lamps on boards AC5 and AC6. Overall lamp operation is summarized in Fig. 3 (for details see under relevant board headings).

### Bus output data

9. When enabled by a low $\overline{\text{ENABLE}}$ OUTPUT signal, the transceivers place data from the control buttons on board AC2 onto the $\overline{\text{PIO}}$ lines to board AC8 and the microcomputer.

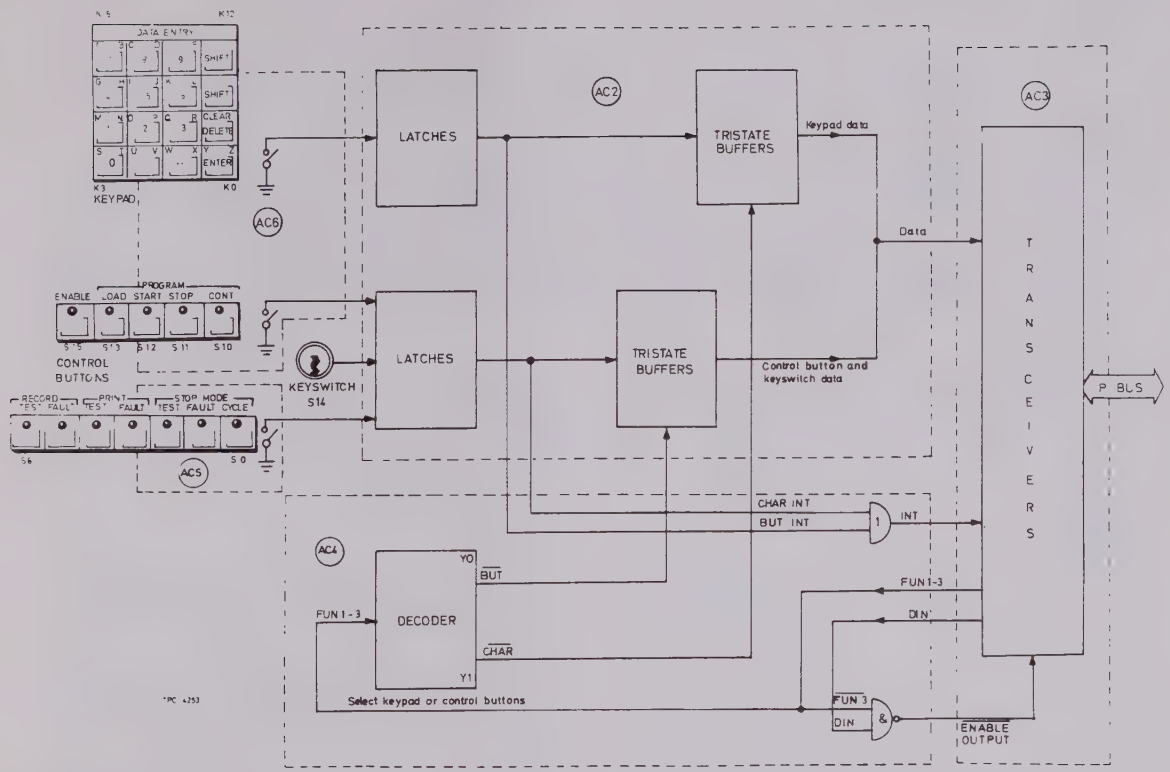


Fig. 2 Switch operation summary
(switches are marked as for -302L version)

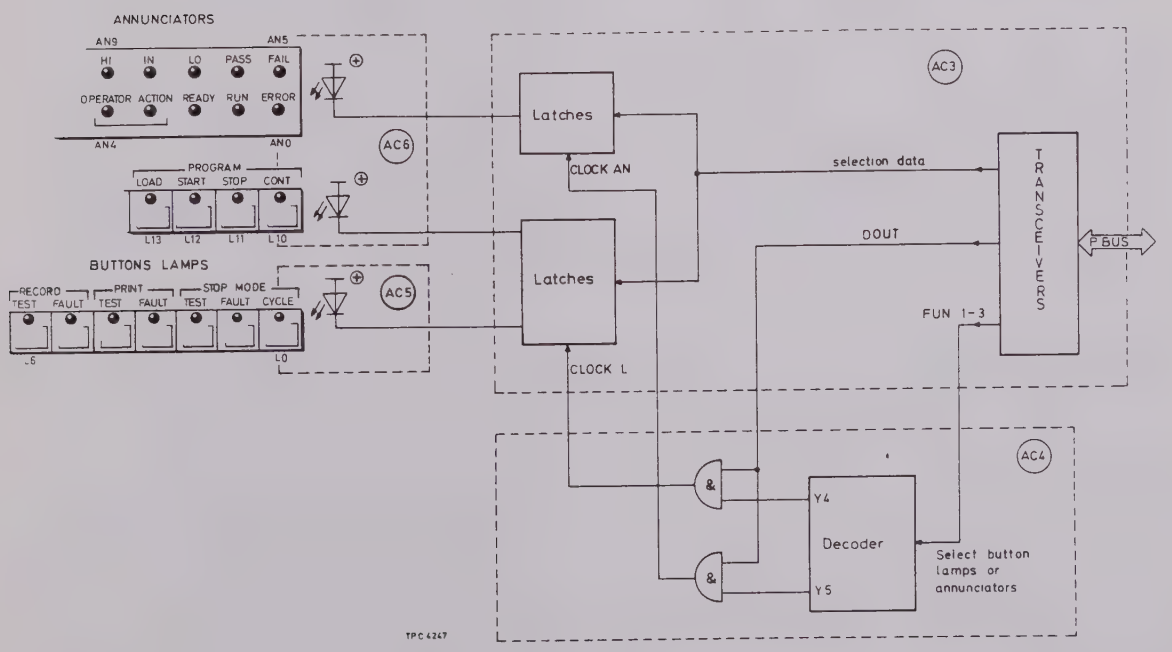


Fig. 3 Lamp operation summary
(lamps are marked as for -302L version)

## AC4 - INTERFACE BOARD

Circuit diagram : Chap. 7, Fig. 5

### Clearing circuit

10. Immediately after switch-on, and until C9 has charged through R10 sufficiently to trigger Schmitt IC8 in the opposite direction, a positive clear pulse is generated. This is fed to PLCA to clear the alphanumeric display and to PLCC to clear the indicator latches on AC3. The clear signal, after inversion, provides the $\overline{\text{RESET}}$ BUT and $\overline{\text{RESET}}$ CHAR signals at PLCC which are used to reset AC2 switch latches ready for operation. When C9 charges, IC11 pin 3 clear input is taken high so that should the power supply subsequently fail causing $\overline{\text{DCOK}}$ to the monostable's B input to go high, a 20 ms clear pulse is automatically generated to reset or clear all latches and the display.

### Control signals

11. Control and status register outputs from AC8 are passed in on the PFUN lines to the 3 to 8 line decoder IC3 which provides the control signals for the unit (see Table 1). All outputs from IC3 are high except for the active control signal which is set low. Y0 and Y1 outputs provide the $\overline{\text{CHAR}}$ and $\overline{\text{BUT}}$ enable signals to AC2 which allow either the keypad switch settings or the control button settings respectively to be passed out to the microcomputer. Y4 and Y5 outputs enable the microcomputer to change the state of the annunciators on AC6 and the button lamps on AC5 and AC6 respectively when gated with $\overline{\text{PDOUT}}$ to form the CLOCK AN and CLOCK L signals. Y6 and Y7 outputs provide the clock signals for the relevant part of the alphanumeric display memory.

TABLE 1 BOARD AC4 3-to-8 LINE DECODER IC3

| INPUT | | | OUTPUT | | | | | | ACTIVE | FUNCTION ENABLED |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 15 | 14 | 11 | 10 | 9 | 7 | SIGNAL | |
| L | L | L | L | H | H | H | H | H | Y0 | CONTROL BUTTONS |
| H | L | L | H | L | H | H | H | H | Y1 | KEYPAD |
| L | L | H | H | H | L | H | H | H | Y4 | BUTTON LAMPS |
| H | L | H | H | H | H | L | H | H | Y5 | ANNUNCIATORS |
| L | H | H | H | H | H | H | L | H | Y6 | DISPLAY UPPER LINE |
| H | H | H | H | H | H | H | H | L | Y7 | DISPLAY LOWER LINE |

H = +5 V ; L = 0 V

Data output operation

12. When a switch is pressed or the key is turned, either BUT INT or CHAR INT is asserted from AC2 which takes INT high to cause a processor interrupt. To determine which switch has been operated the processor responds by commanding an output data operation during which either Y0 or Y1 is set active low. At this time, the $\overline{\text{RESET}}$ BUT and $\overline{\text{RESET}}$ CHAR signals are inactive high causing a high output from IC15 to IC12 pin 5. To take either Y0 or Y1 low $\overline{\text{PFUN3}}$ must be set high and this is also fed to AND gate IC12. When ready to clock data in, the processor sets $\overline{\text{PDIN}}$ low causing IC12 to generate an $\overline{\text{ENABLE}}$ OUTPUT pulse. This is used to send the data to the processor by enabling the transmit function of the P bus transceivers on AC3.

13. At the end of the data transfer the falling edge of the PDIN pulse is used to cause monostable IC11 to generate a 100 ns negative pulse. This is gated with the Y0 or Y1 active level to assert $\overline{\text{RESET}}$ BUT or $\overline{\text{RESET}}$ CHAR. PDIN going low results in $\overline{\text{ENABLE}}$ OUTPUT going passive high. When the switch is released, one of the IC4 monostables generates a 70 ms pulse to keep the appropriate $\overline{\text{RESET}}$ signal asserted. This is to prevent multiple processor interrupts due to switch bounce or to the operator inadventently pressing two buttons at the same time.

SECURE key switch interrupt

14. This part of the circuit detects the change of state which occurs when the SECURE key is turned either way (usually to disable operator intervention via the control panel). When the EN KEY line logic level changes, the rising or falling edge is used to clock one of the D-type bistables forming IC16. Then when clocked, the low on the data input forms the EK-RQS signal to AC2 which initiates an interrupt by means of the BUT INT signal returned to this board. Both bistables are set by the $\overline{\text{RESET}}$ BUT signal.

Alphanumeric display

15. To start the display loading sequence, the processor uses the $\overline{\text{PFUN}}$ lines to set IC3 Y6 or Y7 output active low and this results in the $\overline{\text{DISPLAY}}$ signal. The processor then checks the RDY signal and providing READY is received from the display, RDY is taken high. The processor then places the code for the character on the B1 to B6 lines ready for loading into the display memory (see Fig. 6).

16. The two-line alphanumeric display may be either cumulatively loaded or pre-addressed loaded. There is no erase or blanking facility provided except on power up, and blanking is achieved by overwriting with 'space' characters.

17. Cumulative loading writes characters successively from left to right as in normal writing, starting in the position immediately after the last displayed character and changing to the extreme left of the next line when one line is full.

18. In pre-addressed loading, two facilities are available to the user either separately or simultaneously.

(i) The line can be pre-determined and the next character to be displayed will be in the next position right from the last character regardless of time.

(ii) The next character can be displayed at the beginning of a line.

19. Line addressing is determined by the Y6 and Y7 signals which are decoded from the three $\overline{\text{PFUN}}$ lines, while 'start new line' is achieved by the GO signal (see Fig. 4).

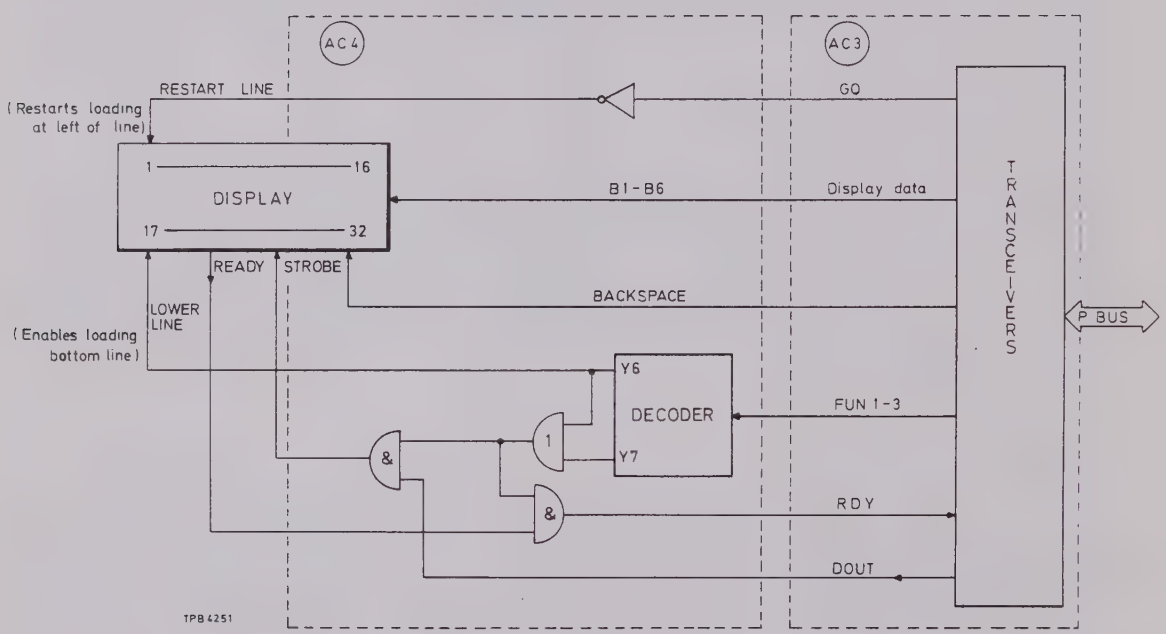


Fig. 4 Display operation summary

## AC5 - SWITCH BOARD

Circuit diagram : Chap. 7, Fig. 6

20. This board contains control button switches S 0 to S6 and button lamps L0 to L6. Operation of a switch connects the output contact to earth which sets an $\overline{R}-\overline{S}$ latch on AC3. The resulting high latch output then initiates an interrupt to service the switch. The anodes of the l.e.d.s are connected to the +5 V rail so that a lamp illuminates when a latch on AC3 takes a l.e.d. cathode low.

## AC6 - INPUT/OUTPUT BOARD

Circuit diagram : Chap. 7, Fig. 7

21. This board contains the keypad switches K0 to K15, annunciators AN0 to AN9, control button switches S10 to S13 and S15 and button lamps L10 to L13 and L15. Operating a switch connects the output contact to earth which sets an $\overline{R}-\overline{S}$ latch on AC3. The resulting high output then initiates an interrupt to service the switch. The anodes of the l.e.d.s are connected to the +5 V rail so that a lamp illuminates when a latch on AC3 takes a l.e.d. cathode low, except for L15 which lights directly via a contact of S15.

## AC7 - POWER SUPPLY BOARD

Circuit diagram : Chap. 7, Fig. 8

### 17 V a.c. input

22. The rectified input from the 17 V secondary of the mains transformer is fed to regulator IC1 which supplies -12 V for the alphanumeric display and for illuminating the SUPPLY lamp.

### 10 V a.c. input

23. The 10 V a.c. input which supplies board logic is rectified on this board before being passed out to the externally connected smoothing capacitor and +5 V regulator.

### 165 V a.c. input

24. The 165 V a.c. input feeds to a series voltage regulator formed by TR1, TR2 and an externally mounted series pass transistor. Voltage control is exercised by TR1 while short circuit protection is provided by TR2. The resulting +147 V regulated output supplies the drive for the display.

Voltage control

25. The output voltage across potential divider R5, R6 and R7 is sampled at the base of TR1 and compared with the reference supplied by Zener diode D13. Potentiometer R6 is set to establish output voltage equilibrium at +147 V. Any increase, for example, in the output voltage will increase the potential on the base of TR1 and increase its conduction. This reduces the potential on the base of the external

series pass transistor and the output current through the load via R4 decreases. The decreased current through the load causes a smaller volts drop across it and the original voltage is restored.

Short circuit protection

26. Output current from the series pass transistor is fed to the load via R4 which is connected across the base and emitter of high current and short circuit protection transistor TR2. Should the output current exceed a safe value, the voltage developed across R4 forward biases the base-emitter junction of TR2 which switches on. This removes the forward bias of the series pass transistor which shuts down. A safe, reduced, current is then supplied from TR2.

## AC8 - PANEL INTERFACE BOARD

Circuit diagram : Chap. 7, Figs. 9 & 10

### General

27. Board AC8 interfaces between the LSI-11 bus connected to the processor and the control panel connected to the P bus. Following address recognition, data representing control button and keypad switch settings are sent to the processor, or data to operate the annunciators, button lamps or display are sent from the processor. Routeing of the data within the control panel is the function of the FUN signals from the control and status register. The operation of the interface is summarized in Fig. 5.

### Data transfer to processor

28. This data transfer process involves interrupt, DATO and DATI cycles as detailed below.

Interrupt

29. When the processor in the TK 1802 wishes to receive interrupts from the TK 1803 it causes interrupt enable bit 6 from the control and status register (CSR) IC15 to be set. When a switch is operated on the TK 1803 it results in INT from AC4 and this is ANDed in IC10 with bit 6. IC10 output provides the clock signal for the first stage of two stages of latches formed by IC14. When clocked, IC14 Q output is taken high to AND gate IC13 together with an input which bypasses the latch. This is to ensure that if the first stage latch is inadvertently triggered by a transient this is not passed on to the second stage. IC13 output asserts BIRQ low to the processor to initiate an interrupt cycle. IC13 output also provides a high data input for the second latch stage so that when the processor sends DIN to service the interrupt IC14 $\overline{Q}$ output is clocked low. Thus when the processor sends the daisy-chained signal IAKI to find out which device is interrupting, the low on IC13 pin 13 prevents the onward transmission of BIAKO.

30. Since SYNC is not asserted during an interrupt, C/D and C/V are set passive high by IC4 so that the B inputs to the multiplexer ICs 18, 19, 23 and 24 are selected for output. This passes the interrupt vector on switch bank SB to the LSI-11 data bus transceivers. IAKI is NANDed in IC4 with the high from the second latch stage IC14 and used via IC9 to negate TRANSMIT DISABLE. The vector points to the appropriate service routine held in memory. The routine would probably commence with the processor addressing the instrument's CSR to set the FUN lines appropriate to interrogate the control button status. If the status shows that a button or keyswitch has been actuated, the appropriate action can be taken. If no actuation is shown the processor would change the FUN code accordingly and obtain the status of the keypad.

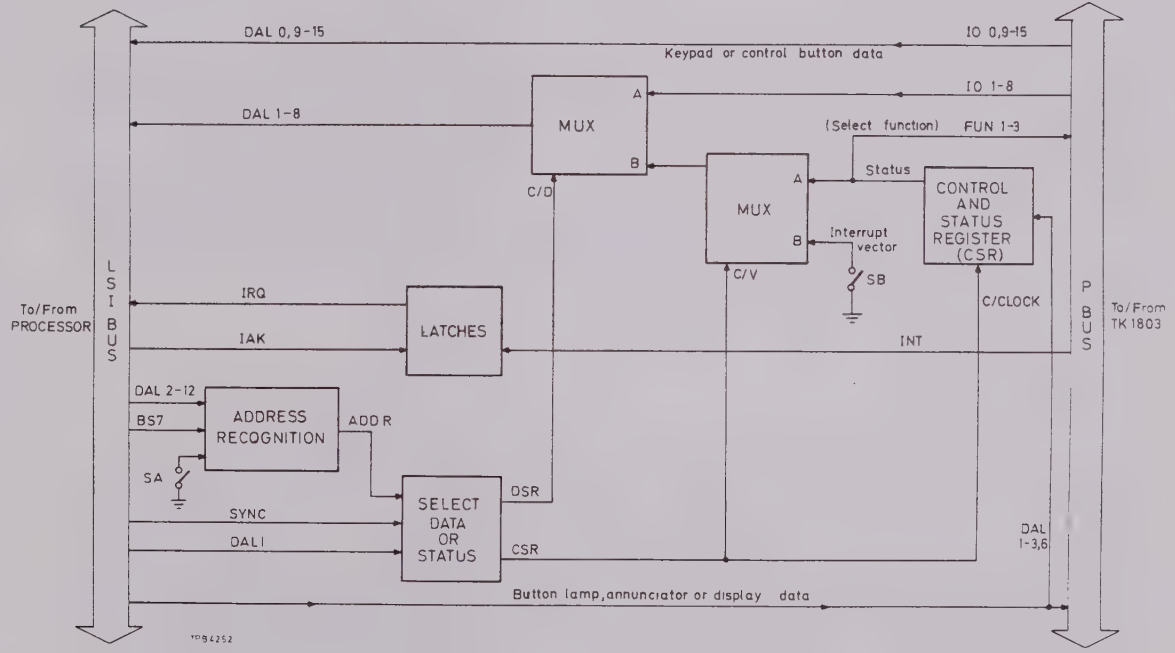


Fig. 5 Interface operation summary

Address recognition

31. During the address phase which precedes a data transfer, the processor places the interface board address on the BDAL 0 to 12 lines with BBS7 asserted low. DAL 3 to DAL 10 lines are taken to exclusive-NOR gates IC22 and IC28 which, along with IC29, perform address recognition. The board address is set on the 8 switches forming switch bank SA and links LK1 and LK2. Only when an address input is at the same logic level as that set on an address switch and link is the output from an exclusive-NOR gate taken high. Also, due to pull-up resistor R6, only when all gate outputs and the DAL 2, 11 and 12 lines are high will the ADDR high signal result. The high ADDR and BS7 signals are gated with the logic level on the DIO 1 line by IC3 to provide the data inputs to two D-type latches of IC2. To address the control register DIO 1 is set low and for the data register DIO 1 is set high.

Accessing switch data

32. At the conclusion of the address phase, BS7 is negated and the address is removed from the data lines. Using a DATO cycle the processor then sends the appropriate code (see Table 4) to the CSR in order to interrogate either the keypad or the control buttons and keyswitch. This code is placed on the data bus and DOUT is asserted when the data have settled. $\overline{\text{DOUT.SYNC.CSR}}$ from IC5 form C/CLOCK to latch out the $\overline{\text{PFUN}}$ selection signals to AC4, as well as the $\overline{\text{BRPLY}}$ signal to the processor to signify acceptance of the data. DOUT and SYNC are then removed to end the cycle.

Obtaining switch data

33. Having interrogated the appropriate set of switches by means of a DATO cycle a DATI cycle follows to obtain the switch data. Following address recognition ADDR is set high and this provides a high data to pin 4 of D-type latch IC2. SYNC then clocks out DSR and when DIN occurs C/D low is gated out from IC4. C/D selects the A inputs (representing the switch data) to multiplexers IC18 and IC23. C/D going low is detected by IC9 which negates TRANSMIT DISABLE so that the data are sent to the processor. IC9 output also forms $\overline{\text{RPLY}}$ which is delayed by Schmitt IC6 to allow the data to settle before activating the $\overline{\text{BRPLY}}$ signal to the processor. The received bit pattern indicates which switches (normally only one) have been operated as shown by Tables 2 and 3. After accepting the data the processor removes DIN which disables the bus transmitters, and negates BRPLY to end the data transfer.

TABLE 2 DATA TO PROCESSOR WHEN CONTROL BUTTON OR KEYSWITCH ACTUATED

| SIGNAL SOURCE | | ACTIVE DATA LINE (DAL) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Control button | S0 | X | | | | | | | | | | | | | | | |
| Control button | S1 | | X | | | | | | | | | | | | | | |
| Control button | S2 | | | X | | | | | | | | | | | | | |
| Control button | S3 | | | | X | | | | | | | | | | | | |
| Control button | S4 | | | | | X | | | | | | | | | | | |
| Control button | S5 | | | | | | X | | | | | | | | | | |
| Control button | S6 | | | | | | | X | | | | | | | | | |
| Control button | S7 | | | | | | | | X | | | | | | | | |
| Control button | S8 | | | | | | | | | X | | | | | | | |
| Control button | S9 | | | | | | | | | | X | | | | | | |
| Control button | S10 | | | | | | | | | | | X | | | | | |
| Control button | S11 | | | | | | | | | | | | X | | | | |
| Control button | S12 | | | | | | | | | | | | | X | | | |
| Control button | S13 | | | | | | | | | | | | | | X | | |
| Control button | S15 | | | | | | | | | | | | | | | | X |
| Keyswitch secure | | | | | | | | | | | | | | | | | |
| Keyswitch open | | | | | | | | | | | | | | | | X | |

TABLE 3 DATA TO PROCESSOR WHEN KEYPAD SWITCH OPERATED

| SIGNAL SOURCE | | ACTIVE DATA LINE (DAL) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Keypad switch | K0 | X | | | | | | | | | | | | | | | |
| Keypad switch | K1 | | X | | | | | | | | | | | | | | |
| Keypad switch | K2 | | | X | | | | | | | | | | | | | |
| Keypad switch | K3 | | | | X | | | | | | | | | | | | |
| Keypad switch | K4 | | | | | X | | | | | | | | | | | |
| Keypad switch | K5 | | | | | | X | | | | | | | | | | |
| Keypad switch | K6 | | | | | | | X | | | | | | | | | |
| Keypad switch | K7 | | | | | | | | X | | | | | | | | |
| Keypad switch | K8 | | | | | | | | | X | | | | | | | |
| Keypad switch | K9 | | | | | | | | | | X | | | | | | |
| Keypad switch | K10 | | | | | | | | | | | X | | | | | |
| Keypad switch | K11 | | | | | | | | | | | | X | | | | |
| Keypad switch | K12 | | | | | | | | | | | | | X | | | |
| Keypad switch | K13 | | | | | | | | | | | | | | X | | |
| Keypad switch | K14 | | | | | | | | | | | | | | | X | |
| Keypad switch | K15 | | | | | | | | | | | | | | | | X |

Data transfer from processor

34. This data transfer process involves two DOUT cycles to light the l.e.d.s, while operating the display involves the addition of a DATI cycle. Since the DATI and DATO cycles have already been covered in detail for a data transfer to the processor these signal sequences will not be repeated here.

35. During the first DATO cycle one of the function selection codes shown in Table 4 is sent to the control and status register to select the required function.

36. To operate the display the DATO cycle is followed by a DATI cycle to read the CSR to see whether bit 7 is set i.e. display ready.

37. The second DATO cycle sends the appropriate code to the data register to alter the information shown by the selected function (see Table 5 and Fig. 6).

TABLE 4 CONTROL WORD

| ACTIVE DATA LINE (DAL) | | | | | | | | FUNCTION SELECTED |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| | | | | | | | | Control buttons and keyswitch |
| | X | | | | | | | Keypad |
| | | | | X | | | | Display backspace |
| | | | X | | | | | Button lamps |
| | X | | X | | | | | Annunciators |
| | | X | X | | | | | Display upper line |
| X | | X | X | | | | | Display upper line start |
| | X | X | X | | | | | Display lower line |
| X | X | X | X | | | | | Display lower line start |
| | | | | | | X | | Interrupt enable |
| | | | | | | | X | Display ready |

TABLE 5 DATA WORD TO ACTIVATE LAMP OR ANNUNCIATOR

| ACTIVE DATA LINE (DAL) | | | | | | | | | | | | | | | | LED LIT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | BUT LAMP | ANNUNCIATOR |
| X | | | | | | | | | | | | | | | | L0 | AN0 |
| | X | | | | | | | | | | | | | | | L1 | AN1 |
| | | X | | | | | | | | | | | | | | L2 | AN2 |
| | | | X | | | | | | | | | | | | | L3 | AN3 |
| | | | | X | | | | | | | | | | | | L4 | AN4 |
| | | | | | X | | | | | | | | | | | L5 | AN5 |
| | | | | | | X | | | | | | | | | | L6 | AN6 |
| | | | | | | | X | | | | | | | | | | AN7 |
| | | | | | | | | X | | | | | | | | | AN8 |
| | | | | | | | | | X | | | | | | | | AN9 |
| | | | | | | | | | | X | | | | | | L10 | AN10 |
| | | | | | | | | | | | X | | | | | L11 | AN11 |
| | | | | | | | | | | | | X | | | | L12 | |
| | | | | | | | | | | | | | X | | | L13 | |

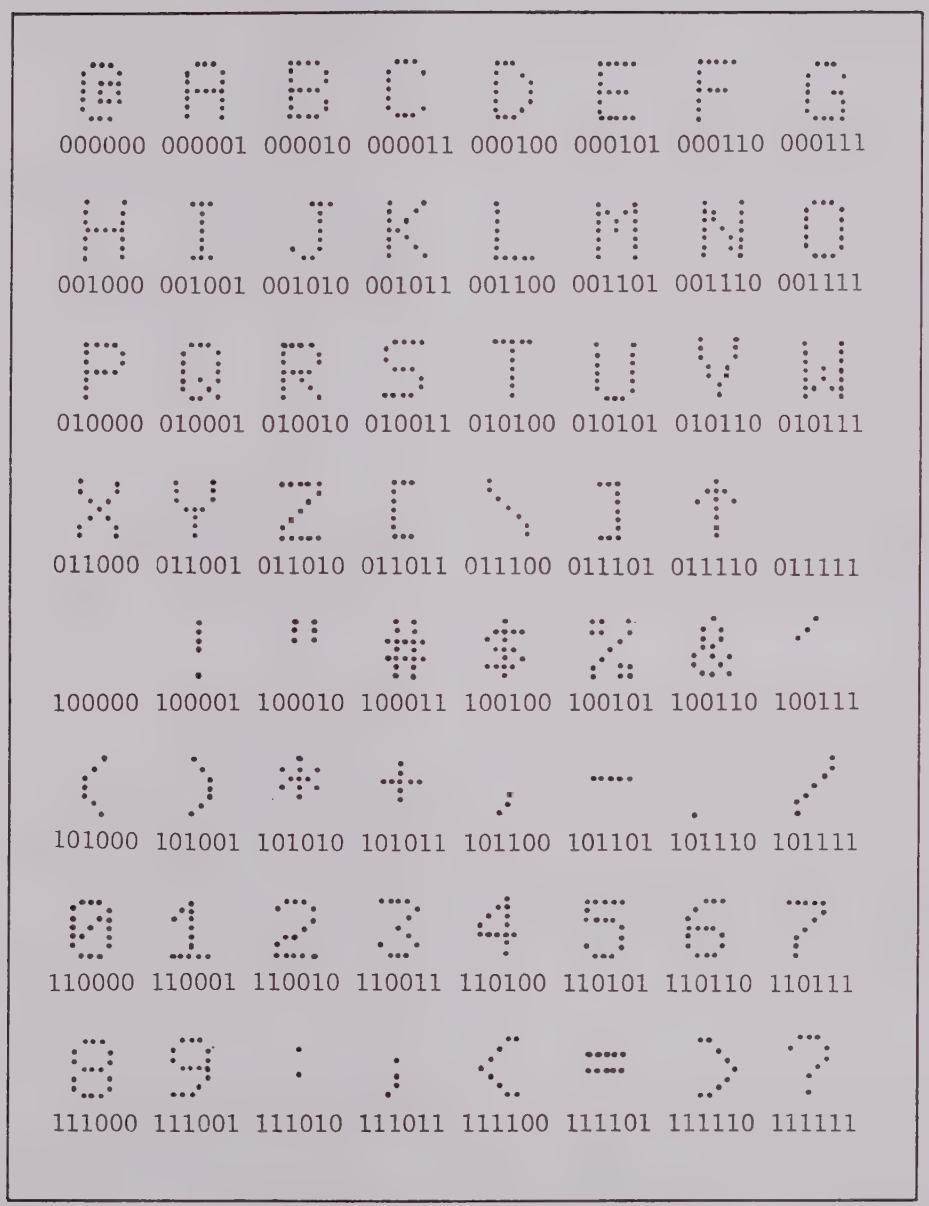


Fig. 6 Display data word (logic levels shown are those on lines B1 to B6).

Chapter 5

# MAINTENANCE

CONTENTS

Para.
1 Function tests
1 RXDP
2 CPANXX
3 REGISTERS

## FUNCTION TESTS

### RXDP

1. A self-test program for the TK 1803 is available on a floppy disk entitled RXDP which is supplied with GPIB Controller TK 1802. To run this program therefore, it is essential to have a floppy disk unit and a compatible interface. Instructions for running the program are given in the Maintenance Chapter of the TK 1802 Instruction Manual H 51802-900C and -901R.

### CPANXX

2. The relevant program for this instrument is Control Panel TK 1803 Diagnostic CPANXX (where XX defines the issue no.). This is essentially a sequential test routine to give assurance of the correct function of the control panel. In the event of a malfunction, diagnostic assistance to component level is not provided and the service engineer must decide for himself a suitable procedure for testing to this level. The program is divided into three sections testing display, output and remote functions.

### REGISTERS

▶ 3. The formats of the control and status register (CSR) and the data buffer register (DBUF) are shown in Fig. 1. Standard addresses for these registers are 176750 and 176752 respectively. The bit allocations for the DBUF are shown in Table 1 while the functions selected by bits 0 to 3 of the CSR are shown in Table 2. To identify the positions of the various switches, lamps, keys and annunciators refer to Chap. 4, Figs. 2 and 3.

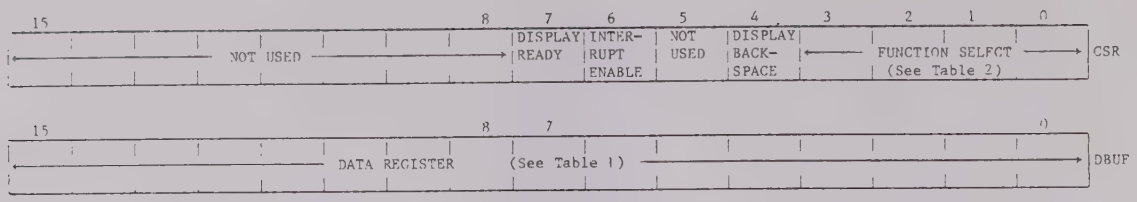


Fig. 1 CSR DBUF register formats.

TABLE 1 DATA BUFFER REGISTER (DBUF) BIT ALLOCATIONS

| SWITCH LAMPS | | S | L | KEYPAD | K | ANNUNCIATORS | AN |
|---|---|---|---|---|---|---|---|
| ENABLE | | 15 | - | 7 | 15 | | - |
| KEYSWITCH | | 14 | - | 8 | 14 | | - |
| LOAD | | 13 | 13 | 9 | 13 | | - |
| START | | 12 | 12 | SHIFT | 12 | | - |
| STOP | | 11 | 11 | 4 | 11 | SPARE | 11 |
| CONT | | 10 | 10 | 5 | 10 | | 10 |
| Optional external switches | | 9 | - | 6 | 9 | HI | 9 |
| | | 8 | - | SHIFT | 8 | IN | 8 |
| | | 7 | - | 1 | 7 | LO | 7 |
| RECORDS | TEST | 6 | 6 | 2 | 6 | PASS | 6 |
| | FAULT | 5 | 5 | 3 | 5 | FAIL | 5 |
| PRINT | TEST | 4 | 4 | DELETE | 4 | OPERATOR ACTION | 4 |
| | FAULT | 3 | 3 | 0 | 3 | | 3 |
| STOP MODE | TEST | 2 | 2 | . | 2 | READY | 2 |
| | FAULT | 1 | 1 | .. | 1 | RUN | 1 |
| | CYCLE | 0 | 0 | ENTER | 0 | ERROR | 0 |

TABLE 2 CONTROL & STATUS REGISTER FUNCTIONS

| FUNCTION | IDENTITY | CSR BIT | | | |
|---|---|---|---|---|---|
| | | 3 | 2 | 1 | 0 |
| CONTROL BUTTONS/KEYSWITCH | S | 0 | 0 | 0 | 0 |
| BUTTON LAMPS | L | 1 | 0 | 0 | 0 |
| KEYPAD | K | 0 | 0 | 1 | 0 |
| ANNUNCIATORS | AN | 1 | 0 | 1 | 0 |
| DISPLAY:- | | | | | |
| UPPER LINE | | 1 | 1 | 0 | 0 |
| UPPER LINE START | | 1 | 1 | 0 | 1 |
| LOWER LINE | | 1 | 1 | 1 | 0 |
| LOWER LINE START | | 1 | 1 | 1 | 1 |

Chapter 6

# REPLACEABLE PARTS

CONTENTS

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## INTRODUCTION

1. Each sub-assembly or printed circuit board in this instrument has been allocated a unit identification e.g. A0, AC1, etc.

2. The complete component reference carries its unit number as a prefix e.g. AC2C3 (capacitor C3 on the switch logic board) but for convenience in the text and on circuit diagrams the prefix is not used. However, when ordering replacements or in correspondence the complete component reference must be quoted.

## ABBREVIATIONS

3. The components are listed in alphanumerical order of the complete circuit reference and the following abbreviations are used :-

| | | | | | |
|---|---|---|---|---|---|
| C | : | capacitor | IC | : | integrated circuit (package) |
| Carb | : | carbon | L | : | inductor |
| Cer | : | ceramic | Met | : | metal |
| D | : | semiconductor diode | PL | : | plug |
| Elec | : | electrolytic | Plas | : | plastic |
| FS | : | fuse | R | : | resistor |

| | | | | | |
|---|---|---|---|---|---|
| S | : | switch | TR | : | transistor |
| SK | : | socket | Var | : | variable |
| T | : | transformer | W | : | watts at 70°C |
| Tant | : | tantalum | X | : | ferrite bead |
| TP | : | terminal | † | : | values selected during test; nominal value listed |

## COMPONENT VALUES

4. One or more of the components fitted in this instrument may differ from those listed in this chapter for any of the following reasons :

(a) Components indicated by a † have their values selected during test to achieve particular performance limits.

(b) Owing to supply difficulties, components of different value or type may be substituted provided the overall performance of the instrument is maintained.

(c) As part of a policy of continuous development, components may be changed in value or type to obtain detail improvements in performance.

5. When there is a difference between the component fitted and the one listed, always use as a replacement the same type and value as found in the instrument.

## ORDERING

6. When ordering replacements, address the order to our Service Division (address inside rear cover) or nearest agent and specify the following for each component required :

(1) Type* and serial number of instrument.

(2) Complete circuit reference.

(3) Description.

(4) Marconi Instruments code number.

* As given on the serial number label at the rear of the instrument; if this is superseded by a model number label, quote the model number instead of the type number.

COMPONENTS

7. Unit A0 - Main chassis (basic)

When ordering,prefix circuit reference with A0

| Circuit reference | Description | Code no. |
|---|---|---|
| | Interface cable assembly, 40-way | 43129-361Z |
| | Interface cable clamp | 34900-507Y |
| | Display cable assembly, 34-way | 43129-362H |
| | Alphanumeric display | 28224-496B |
| C1 | Elec 33μF +50-20% 450V | 26417-656W |
| C2 | Elec 10 000μF +50-10% 25V | 26426-095R |
| C3 | Plas 1.0μF 10% 50V | 26582-432F |
| C4 | Plas 1.0μF 10% 50V | 26582-432F |
| FS1,2 | Fuse, super time-lag, 1.25 A (230 V) | 23411-068E |
| | Fuse, super time-lag, 2.5 A (115 V) | 23411-069U |
| FS3 | Fuse, time-lag, 250 mA | 23411-055P |
| | Fuseholder (1 of 3) | 23416-192R |
| | Fuseholder cover (1 of 3) | 23416-198E |
| IC1 | Voltage regulator LM323 | 28461-714D |
| LP1 | Power indicator | 23735-456E |
| PL | Polarizing | 23435-190G |
| PL | Connector/mains filter | 23423-150L |
| SAA | SUPPLY ON | 23465-297M |
| SAB | SECURE keyswitch | 23462-056F |
| SAC | SUPPLY RANGE | 23467-161W |
| | Locking plate | 35901-630H |
| SK | SUPPLY OUT | 23424-161H |
| T1 | Transformer | 43490-064X |
| TR1 | 2N4240 | 28458-657Z |
| | Heatsink | 34900-449D |

Mechanical parts (basic)

| | |
|---|---|
| Rear panel assembly | 35902-293C |
| Support panel assembly | 35902-294R |
| PCB restrainer | 41700-279M |
| Board guide (1 of 6) | 37574-512R |

8. Board AC1 - Mother board

When ordering, prefix circuit reference with AC1

| Circuit reference | Description | Code no. |
|---|---|---|
| | Complete board | 44827-887T |
| PLA | Terminal post | 23435-121J |
| SKA | Edge connector, 40-way double sided | 23435-073Z |
| SKB | Edge connector, 40-way double sided | 23435-073Z |
| SKC | Edge connector, 40-way double sided | 23435-073Z |
| SKD | IC socket, 24-pin | 28488-044N |
| SKE | IC socket, 16-pin | 28488-041E |
| SKF | IC socket, 16-pin | 28488-041E |

9. Board AC2 - Switch logic

When ordering, prefix circuit reference with AC2

| | | |
|---|---|---|
| | Complete board | 44827-888P |
| C1 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C2 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C3 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C4 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C5 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C6 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C7 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C8 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C9 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C10 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C11 | Elec 22μF 20% 25V | 26421-114E |
| IC1 | 74LS279 | 28462-107F |
| IC2 | 74LS260 | 28466-217J |
| IC3 | 74118 | 28462-106J |
| IC4 | 74LS244 | 28469-182T |
| IC5 | 74118 | 28462-106J |
| IC6 | 74LS244 | 28469-182T |
| IC7 | 74118 | 28462-106J |
| IC8 | 74LS244 | 28469-182T |
| IC9 | 74118 | 28462-106J |
| IC10 | 74LS260 | 28466-217J |

9. Board AC2 - Switch logic (continued)

| Circuit reference | Description | Code no. |
|---|---|---|
| IC11 | 74118 | 28462-106J |
| IC12 | 74LS244 | 28469-182T |
| IC13 | 74LS260 | 28466-217J |
| IC14 | 74LS20 | 28466-347U |
| IC15 | 7407 | 28469-703X |
| R1 | Package 470Ω 2% | 24681-617R |
| R2 | Package 470Ω 2% | 24681-617R |
| R3 | Package 4.7kΩ 2% | 24681-608D |
| R4 | Package 4.7kΩ 2% | 24681-608D |
| R5 | Package 4.7kΩ 2% | 24681-608D |
| R6 | Package 4.7kΩ 2% | 24681-608D |

10. Board AC3 - Indicator logic

When ordering, prefix circuit reference with AC3

| | | |
|---|---|---|
| | Complete board | 44827-889X |
| C1 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C2 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C3 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C4 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C5 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C6 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C7 | Cer 0.1μF 80-20% 30V | 26383-031S |
| IC1 | 74LS174 | 28462-612Z |
| IC2 | 7406 | 28469-158A |
| IC3 | 74LS174 | 28462-612Z |
| IC4 | 7406 | 28469-158A |
| IC5 | 74LS174 | 28462-612Z |
| IC6 | 74LS174 | 28462-612Z |
| IC7 | 7406 | 28469-158A |
| IC8 | 7406 | 28469-158A |
| IC9 | 8738 | 28469-175V |
| IC10 | 8738 | 28469-175V |
| IC11 | 8738 | 28469-175V |
| IC12 | 8738 | 28469-175V |
| IC13 | 8738 | 28469-175V |
| PLBA | Connector | 23435-997Z |

10. Board AC3 - Indicator logic (continued)

When ordering, prefix circuit reference with AC3

| Circuit reference | Description | Code no. |
|---|---|---|
| R1 | Met film 150Ω 2% ¼W | 24773-253F |
| R2 | Met film 150Ω 2% ¼W | 24773-253F |
| R3 | Met film 150Ω 2% ¼W | 24773-253F |
| R4 | Met film 150Ω 2% ¼W | 24773-253F |
| R5 | Met film 150Ω 2% ¼W | 24773-253F |
| R6 | Met film 150Ω 2% ¼W | 24773-253F |
| R7 | Met film 150Ω 2% ¼W | 24773-253F |
| R8 | Met film 150Ω 2% ¼W | 24773-253F |
| R9 | Met film 150Ω 2% ¼W | 24773-253F |
| R10 | Met film 150Ω 2% ¼W | 24773-253F |
| R11 | Met film 150Ω 2% ¼W | 24773-253F |
| R12 | Met film 150Ω 2% ¼W | 24773-253F |
| R13 | Met film 150Ω 2% ¼W | 24773-253F |
| R14 | Met film 150Ω 2% ¼W | 24773-253F |
| R15 | Met film 150Ω 2% ¼W | 24773-253F |
| R16 | Met film 150Ω 2% ¼W | 24773-253F |
| R17 | Met film 150Ω 2% ¼W | 24773-253F |
| R18 | Met film 150Ω 2% ¼W | 24773-253F |
| R19 | Met film 150Ω 2% ¼W | 24773-253F |
| R20 | Met film 150Ω 2% ¼W | 24773-253F |
| R21 | Met film 150Ω 2% ¼W | 24773-253F |
| R22 | Met film 150Ω 2% ¼W | 24773-253F |
| R23 | Met film 150Ω 2% ¼W | 24773-253F |
| R24 | Met film 150Ω 2% ¼W | 24773-253F |
| R30 | Package 2.7kΩ 2% | 24681-604G |
| R31 | Package 2.7kΩ 2% | 24681-604G |
| R32 | Package 2.7kΩ 2% | 24681-604G |
| R33 | Package 2.7kΩ 2% | 24681-604G |
| R34 | Package 2.7kΩ 2% | 24681-604G |

11. Board AC4 - Interface

When ordering, prefix circuit reference with AC4

| | | |
|---|---|---|
| | Complete board | 44827-890T |
| C1 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C2 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C3 | Elec 4.7μF 20% 35V | 26421-108A |

11. Board AC4 - Interface (continued)

| Circuit reference | Description | Code no. |
|---|---|---|
| C4 | Elec 4.7μF 20% 35V | 26421-108A |
| C5 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C6 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C7 | Plas 820pF 2% 160V | 26516-462X |
| C8 | Plas 820pF 2% 160V | 26516-462X |
| C9 | Elec 22μF 20% 25V | 26421-114E |
| C10 | Elec 4.7μF 20% 35V | 26421-108A |
| C11 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C12 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C13 | Plas 47pF ±2pF 160V | 26516-165E |
| C14 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C15 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C16 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C17 | Elec 22μF 20% 25V | 26421-114E |
| D1 | Zener BZX79C3V3 | 28371-210D |
| D2 | 1N4148 | 28336-676J |
| IC1 | 74LS02 | 28466-214Y |
| IC2 | 74LS32 | 28466-108U |
| IC3 | 74LS138 | 28465-027F |
| IC4 | 74LS123 | 28468-309B |
| IC5 | 74LS04 | 28469-171L |
| IC6 | 74LS04 | 28469-171L |
| IC7 | 8T37 | 28469-174G |
| IC8 | 74LS14 | 28469-176S |
| IC9 | 74LS02 | 28466-214Y |
| IC10 | 74LS27 | 28466-216L |
| IC11 | 74LS221 | 28468-404B |
| IC12 | 74LS10 | 28466-351Y |
| IC13 | 74LS02 | 28466-214Y |
| IC14 | 74LS04 | 28469-171L |
| IC15 | 74LS02 | 28466-214Y |
| IC16 | 74LS74 | 28462-611A |
| IC17 | 74LS32 | 28466-108U |
| IC18 | 74LS02 | 28466-214Y |
| PLCA | PCB header, 34-way | 23435-122F |

11. Board AC4 - Interface (continued)

| Circuit reference | Description | Code no. |
|---|---|---|
| R1 | Met film 4.7kΩ 2% ¼W | 24773-289W |
| R2 | Met film 4.7kΩ 2% ¼W | 24773-289W |
| R3 | Met film 33kΩ 2% ¼W | 24773-309Z |
| R4 | Met film 33kΩ 2% ¼W | 24773-309Z |
| R5 | Met film 4.7kΩ 2% ¼W | 24773-289W |
| R6 | Met film 120Ω 2% ¼W | 24773-251L |
| R7 | Met film 180Ω 2% ¼W | 24773-255V |
| R8 | Met film 220Ω 2% ¼W | 24773-257W |
| R9 | Met film 220Ω 2% ¼W | 24773-257W |
| R10 | Met film 6.8kΩ 2% ¼W | 24773-293D |
| R11 | Met film 33Ω 2% ¼W | 24773-237K |
| R12 | Met film 330Ω 2% ¼W | 24773-261D |
| R13 | Met film 6.8kΩ 2% ¼W | 24773-293D |
| R14 | Met film 4.7kΩ 2% ¼W | 24773-289W |
| R15 | Met film 4.7kΩ 2% ¼W | 24773-289W |
| R16 | Met film 4.7kΩ 2% ¼W | 24773-289W |
| TR1 | BC238 | 28452-781A |
| TR2 | BC238 | 28452-781A |

12. Board AC5 - Switch board

When ordering, prefix circuit reference with AC5

| | | |
|---|---|---|
| | Complete board | 44827-891P |
| | Switch cable assembly | 43129-365Y |
| SA00-06 | Switch bank | |
| | Switch body (1 of 7) | 23465-441B |
| | Switch button, s.t.k.l., black (1 of 7) | 23465-443B |
| | Switch l.e.d., yellow (1 of 7) | 28624-121Z |

13. Board AC6 - Input/output

When ordering, prefix circuit reference with AC6

| | |
|---|---|
| Complete board | 44827-892X |
| Keypad cable assembly | 43129-363E |
| Input/output cable assembly | 43129-364U |

13. Board AC6 - Input/output (continued)

| Circuit reference | Description | Code no. |
|---|---|---|
| D300-309 | Annunciators | |
| | Annunciators l.e.d. green (1 of 3) | 28624-113C |
| | Annunciators l.e.d. yellow (1 of 3) | 28624-114R |
| | Annunciators l.e.d. red (1 of 4) | 28624-115B |
| SB00-15 | Keypad complete | 44990-268U |
| SC10-13,15 | Switch bank | |
| | Switch body (1 of 5) | 23465-411B |
| | Switch button, s.t.k.l., black (1 of 4) | 23465-443B |
| | Switch button, s.t.k.l., grey | 23465-445A |
| | Switch l.e.d., yellow (1 of 5) | 28624-121Z |

14. Board AC7 - Power supply

When ordering, prefix circuit reference with AC7

| | | |
|---|---|---|
| | Complete board | 44827-893M |
| C1 | Elec 470μF 100-20% 40V | 26415-823V |
| C2 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C3 | Cer 0.1μF 80-20% 30V | 26383-031S |
| C4 | Plas 0.1μF 10% 250V | 26582-208B |
| C5 | Plas 0.15μF 10% 100V | 26582-212K |
| C6 | Plas 0.15μF 10% 100V | 26582-212K |
| C7 | Plas 0.047μF 10% 400V | 26582-238C |
| D1 | 1N5401 | 28355-723N |
| D2 | 1N5401 | 28355-723N |
| D3 | 1N5401 | 28355-723N |
| D4 | 1N5401 | 28355-723N |
| D5 | 1N4006 | 28358-808H |
| D6 | 1N4006 | 28358-808H |
| D7 | 1N4006 | 28358-808H |
| D8 | 1N4006 | 28358-808H |
| D9 | 1N4004 | 28357-028K |
| D10 | 1N4004 | 28357-028K |
| D11 | 1N4004 | 28357-028K |
| D12 | 1N4004 | 28357-028K |
| D13 | Zener ZPY82 | 28377-723Y |
| IC1 | +12V regulator | 28461-708V |
| R1 | Met ox 68kΩ 2% ½W | 24573-117C |
| R2 | Met ox 68kΩ 2% ½W | 24573-117C |
| R3 | Met ox 33kΩ 2% ½W | 24573-109D |
| R4 | Met film 16Ω 2% ¼W | 24773-230T |
| R5 | Met film 22kΩ 2% ¼W | 24773-305R |
| R6 | Var cermet 10kΩ 10% ½W | 25711-641G |
| R7 | Met ox 33kΩ 2% ½W | 24573-109D |

14. Board AC7 - Power supply (continued)

| Circuit reference | Description | Code no. |
|---|---|---|
| TR1 | 2N3440 | 28458-617C |
| TR2 | 2N3440 | 28458-617C |

15. Board AC8 - Panel interface

When ordering, prefix circuit reference with AC8

| | | |
|---|---|---|
| | Complete board | 44827-894C |
| C1 | Plas 0.01µF 10% 400V | 26582-303D |
| C2 | Plas 0.01µF 10% 400V | 26582-303D |
| C3 | Plas 0.01µF 10% 400V | 26582-303D |
| C4 | Plas 0.01µF 10% 400V | 26582-303D |
| C5 | Plas 0.01µF 10% 400V | 26582-303D |
| C6 | Plas 1500pF 2% 160V | 26516-524S |
| C7 | Plas 22pF ±2pF 160V | 26516-088K |
| C8 | Plas 0.01µF 10% 400V | 26582-303D |
| C9 | Plas 0.01µF 10% 400V | 26582-303D |
| C10 | Plas 0.01µF 10% 400V | 26582-303D |
| C11 | Plas 0.01µF 10% 400V | 26582-303D |
| C12 | Plas 0.01µF 10% 400V | 26582-303D |
| C13 | Plas 0.01µF 10% 400V | 26582-303D |
| C14 | Plas 0.01µF 10% 400V | 26582-303D |
| C15 | Plas 0.01µF 10% 400V | 26582-303D |
| C16 | Plas 0.01µF 10% 400V | 26582-303D |
| C17 | Plas 0.01µF 10% 400V | 26582-303D |
| C18 | Tant 6.8µF 20% 6V | 26486-560W |
| C19 | Tant 6.8µF 20% 6V | 26486-560W |
| D1 | 1N4148 | 28336-676J |
| IC1 | 8T37 | 28469-174G |
| IC2 | 74LS175 | 28462-614E |
| IC3 | 74LS11 | 28466-014F |
| IC4 | 74LS10 | 28466-351Y |
| IC5 | 74LS10 | 28466-351Y |
| IC6 | 74LS14 | 28469-176S |
| IC7 | 74LS221 | 28468-404D |
| IC8 | 74LS04 | 28469-171L |
| IC9 | 74LS11 | 28466-014F |
| IC10 | 74LS08 | 28466-012L |

15. Board AC8 - Panel interface (continued)

| Circuit reference | Description | Code no. |
|---|---|---|
| IC11 | 7406 | 28469-158A |
| IC12 | 8T38 | 28469-175V |
| IC13 | 74LS08 | 28466-012L |
| IC14 | 74LS74 | 28462-611A |
| IC15 | 74LS174 | 28462-612Z |
| IC16 | 8T38 | 28469-175V |
| IC17 | 8T38 | 28469-175V |
| IC18 | 74LS157 | 28469-707B |
| IC19 | 74LS157 | 28469-707B |
| IC20 | 8T38 | 28469-175V |
| IC21 | 8T38 | 28469-175V |
| IC22 | 74LS266 | 28466-298C |
| IC23 | 74LS157 | 28469-707B |
| IC24 | 74LS157 | 28469-707B |
| IC25 | 8T38 | 28469-175V |
| IC26 | 8T38 | 28469-175V |
| IC27 | 8T38 | 28469-175V |
| IC28 | 74LS266 | 28466-298C |
| IC29 | 74LS05 | 28469-178D |
| IC30 | 8T38 | 28469-175V |
| IC31 | 8T38 | 28469-175V |
| PLGA | Header, 40-way | 23435-124V |
| R1 | Met film 220Ω 2% $\frac{1}{4}$W | 24773-257W |
| R2 | Package 4.7kΩ 2% | 24681-608D |
| R3 | Met film 180Ω 2% $\frac{1}{4}$W | 24773-255V |
| R4 | Met film 180Ω 2% $\frac{1}{4}$W | 24773-255V |
| R5 | Met film 390Ω 2% $\frac{1}{4}$W | 24773-263P |
| R6 | Met film 1kΩ 2% $\frac{1}{4}$W | 24773-273A |
| R7 | Met film 180Ω 2% $\frac{1}{4}$W | 24773-255V |
| R8 | Met film 180Ω 2% $\frac{1}{4}$W | 24773-255V |
| R9 | Met film 390Ω 2% $\frac{1}{4}$W | 24773-263P |
| R10 | Met film 390Ω 2% $\frac{1}{4}$W | 24773-263P |
| R11 | Package 4.7kΩ 2% | 24681-608D |
| R12 | Package 4.7kΩ 2% | 24681-608D |
| R13 | Met film 390Ω 2% $\frac{1}{4}$W | 24773-263P |
| SA | Address, 8 rocker switch bank | 23465-899J |
| SB | Vector, 6 rocker switch bank | 23465-897N |

Chapter 7

# SERVICING DIAGRAMS

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Para.

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1 Component values
2 Symbols
3 PCB layouts

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## CIRCUIT NOTES

### Component values

1. Resistors : No suffix = ohms, k = kilohms, M = megohms.
Capacitors : No suffix = microfarads, n = nanofarads, p = picofarads.

### Symbols

2. Symbols are to BS 3939 with the following additions :

Test point

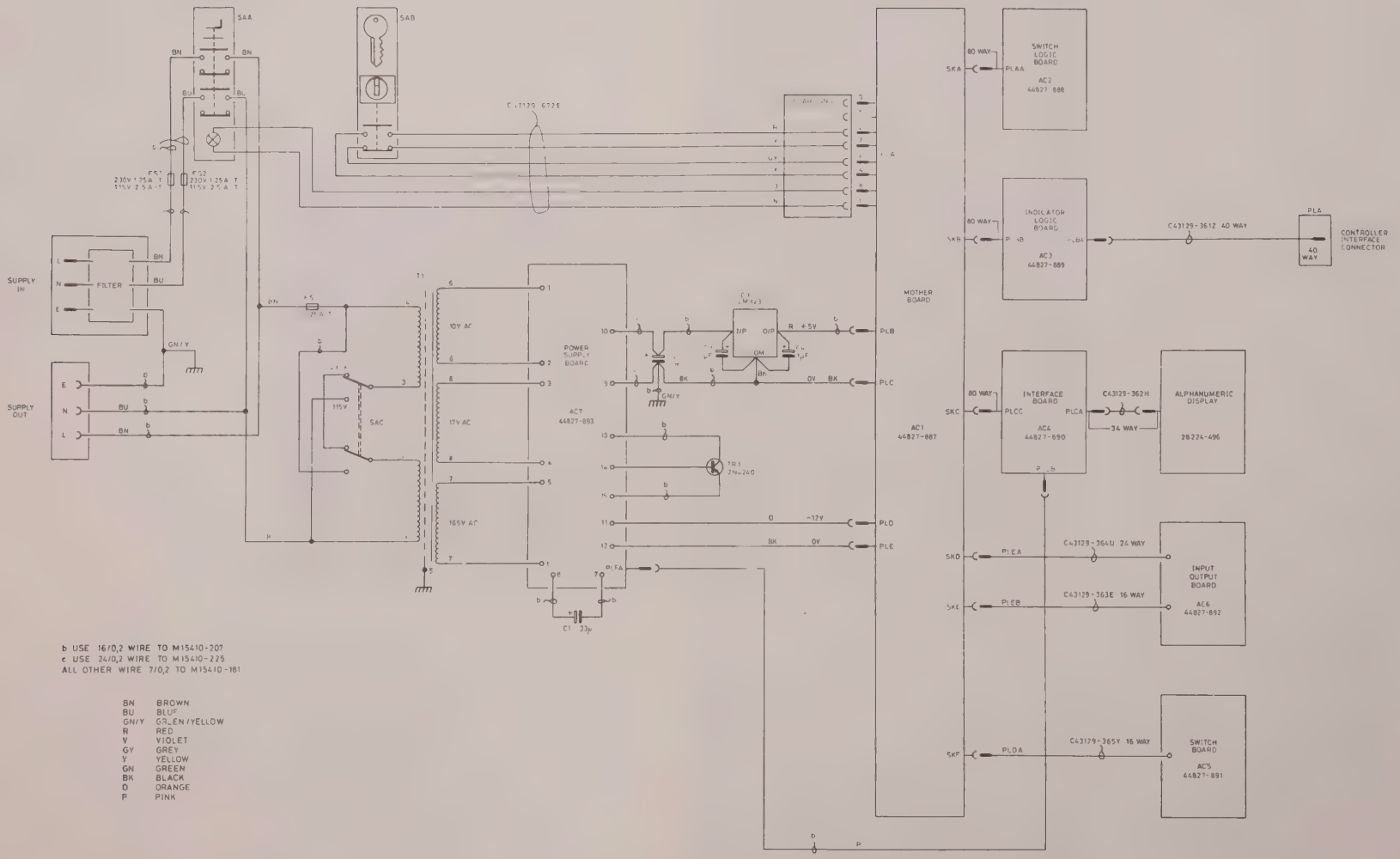
Edge connector

Ferrite bead

Unit identification

### PCB layouts

3. PCB layouts are shown as viewed from the component side.




b USE 16/0,2 WIRE TO M15410-207
c USE 24/0,2 WIRE TO M15410-225
ALL OTHER WIRE 7/0,2 TO M15410-181

| | |
|---|---|
| BN | BROWN |
| BU | BLUE |
| GN/Y | GREEN/YELLOW |
| R | RED |
| V | VIOLET |
| GY | GREY |
| Y | YELLOW |
| GN | GREEN |
| BK | BLACK |
| O | ORANGE |
| P | PINK |

Drg. No. Z 51803-900P Sht. 1 of 1, Iss. 7

Unit A0 : Wiring diagram

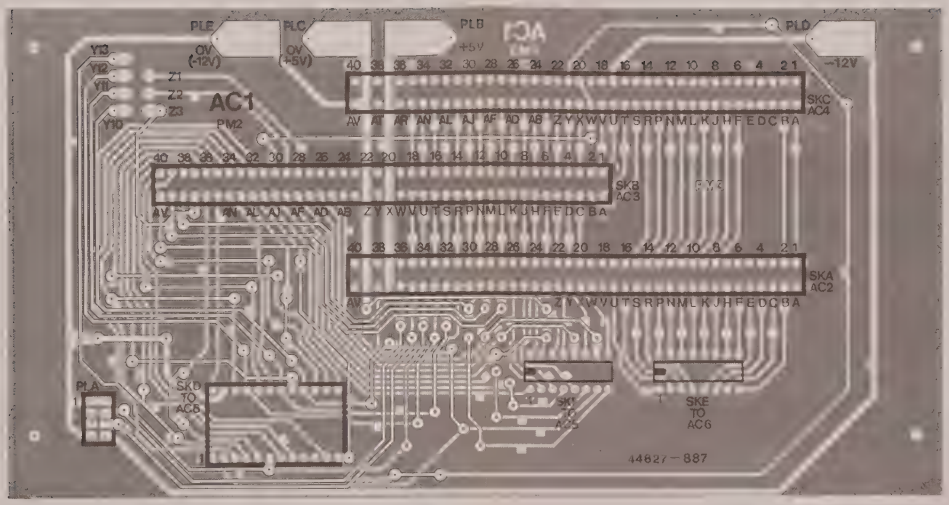
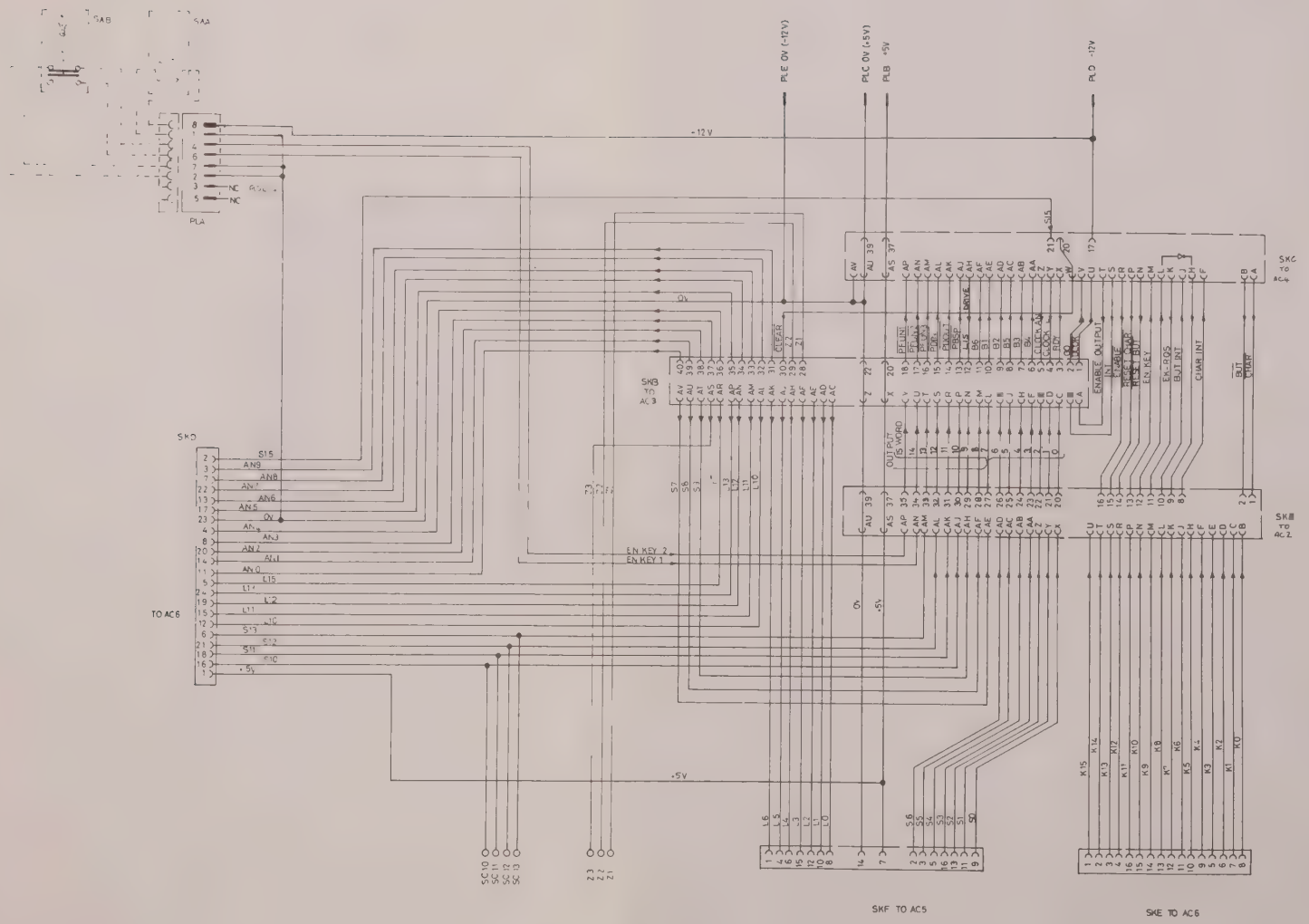



Fig. 2a Board AC1

Component layout




Drg. No. Z 44827-887T Sht. 1 of 1, Iss. 4

Board AC1 : Mother board

Fig. 2

Jul. 81 (Am. 3)

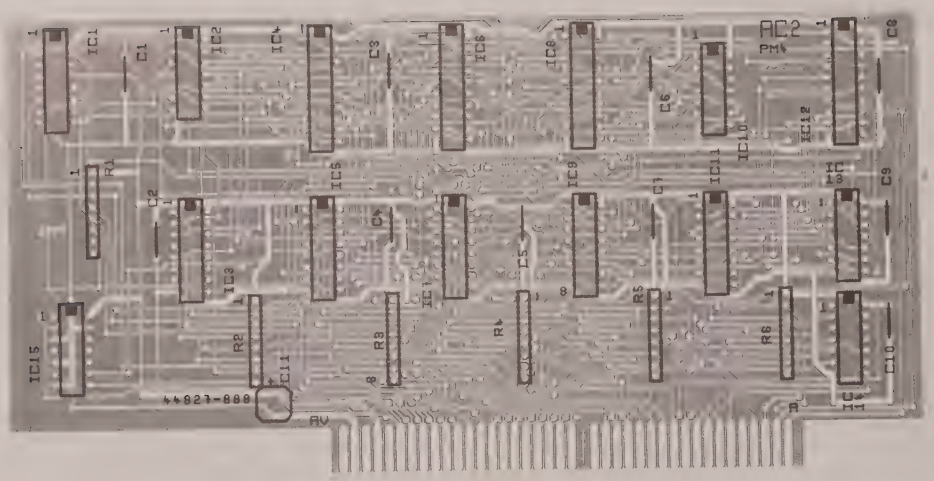
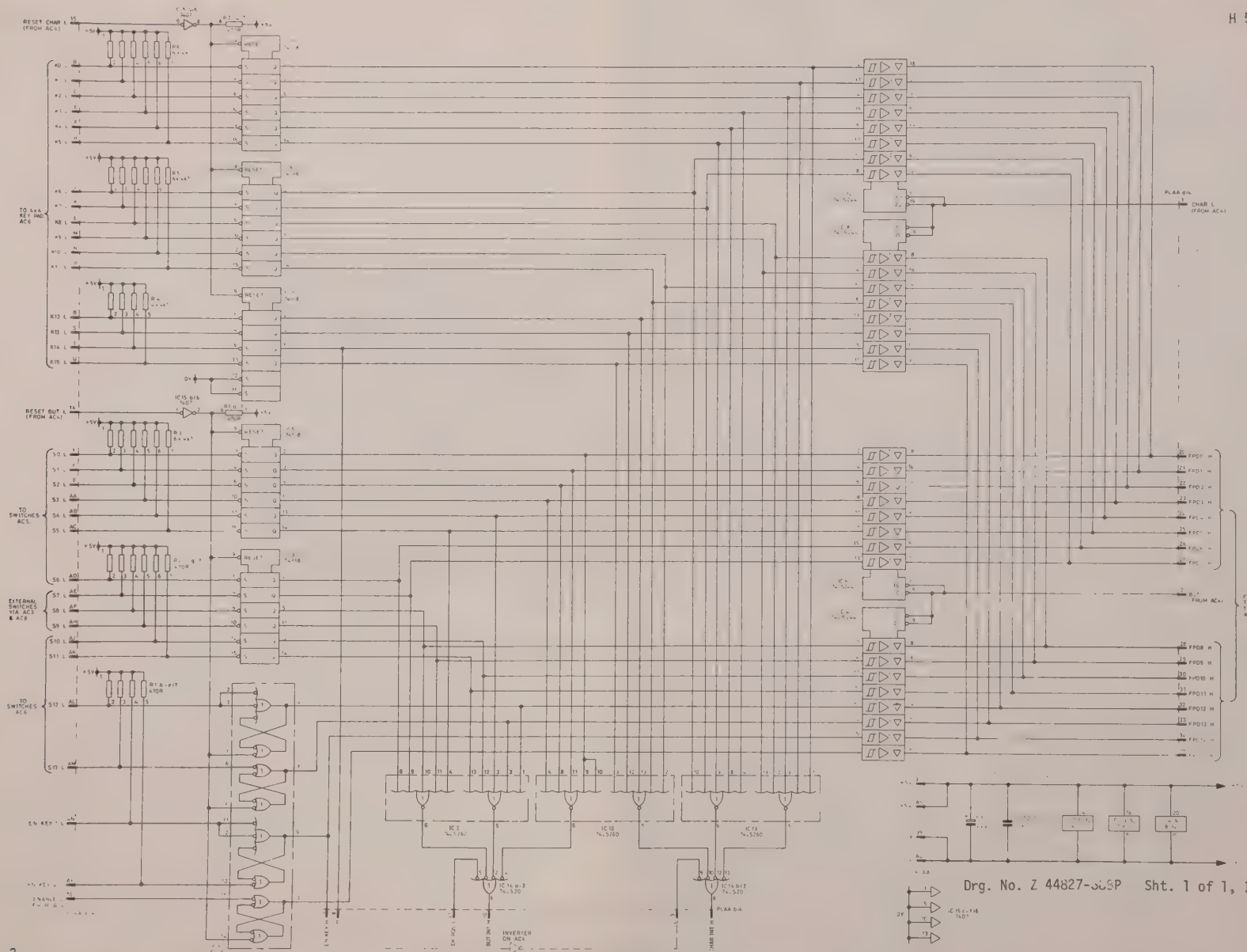



Fig. 3a Board AC2

Component layout


RESET CHAR L (FROM AC4)
TO 4x4 KEY PAD AC6
RESET BUT L (FROM AC4)
TO SWITCHES AC5
EXTERNAL SWITCHES VIA AC3 & AC8
TO SWITCHES AC6
EN KEY L
ENABLE
INVERTER ON AC4
PLAA 6/4
CHAR L (FROM AC4)
FRONT PANEL DATA TO AC8 VIA BUS TRANSMITTERS ON AC1
Drg. No. Z 44827-309P Sht. 1 of 1, Iss. 6

Board AC2 : Switch logic

Fig. 3

Jul. 83 (Am. 5)

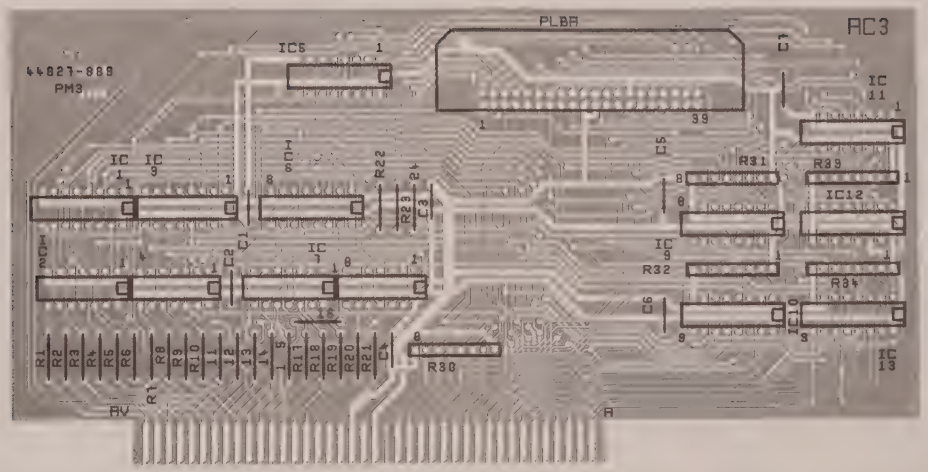
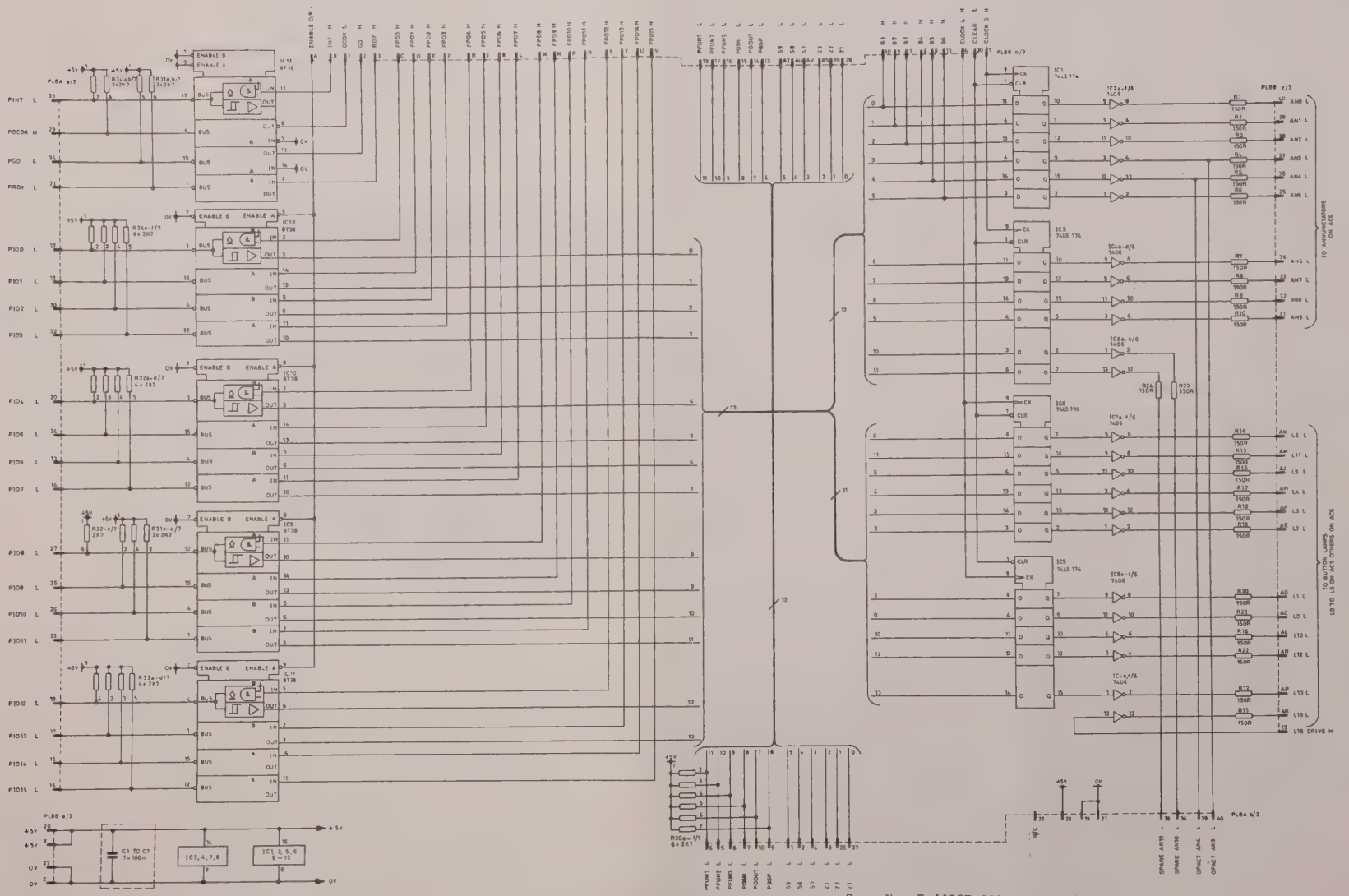



Fig. 4a Board AC3

Component layout



Drg. No. Z 44827-889X Sht. 1 of 1, Iss. 6

Fig. 4

Board AC3 : Indicator logic

Nov. 83 (Am. 6)

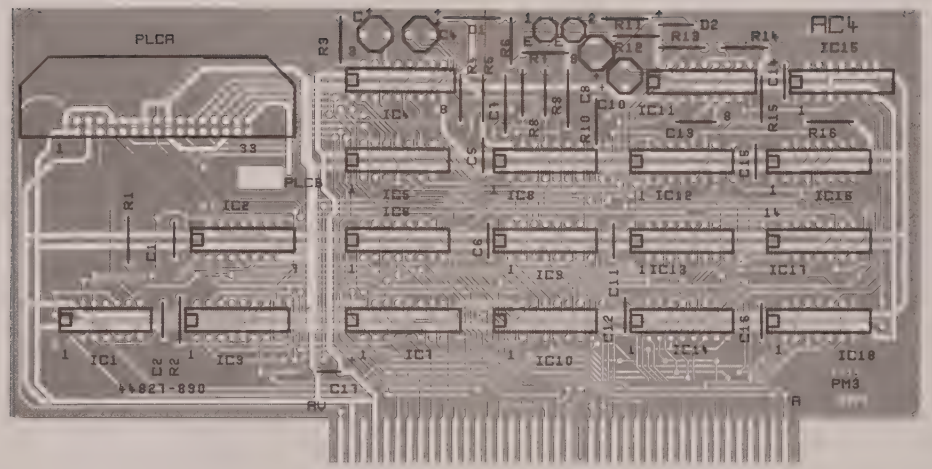



Fig. 5a Board AC4

Component layout

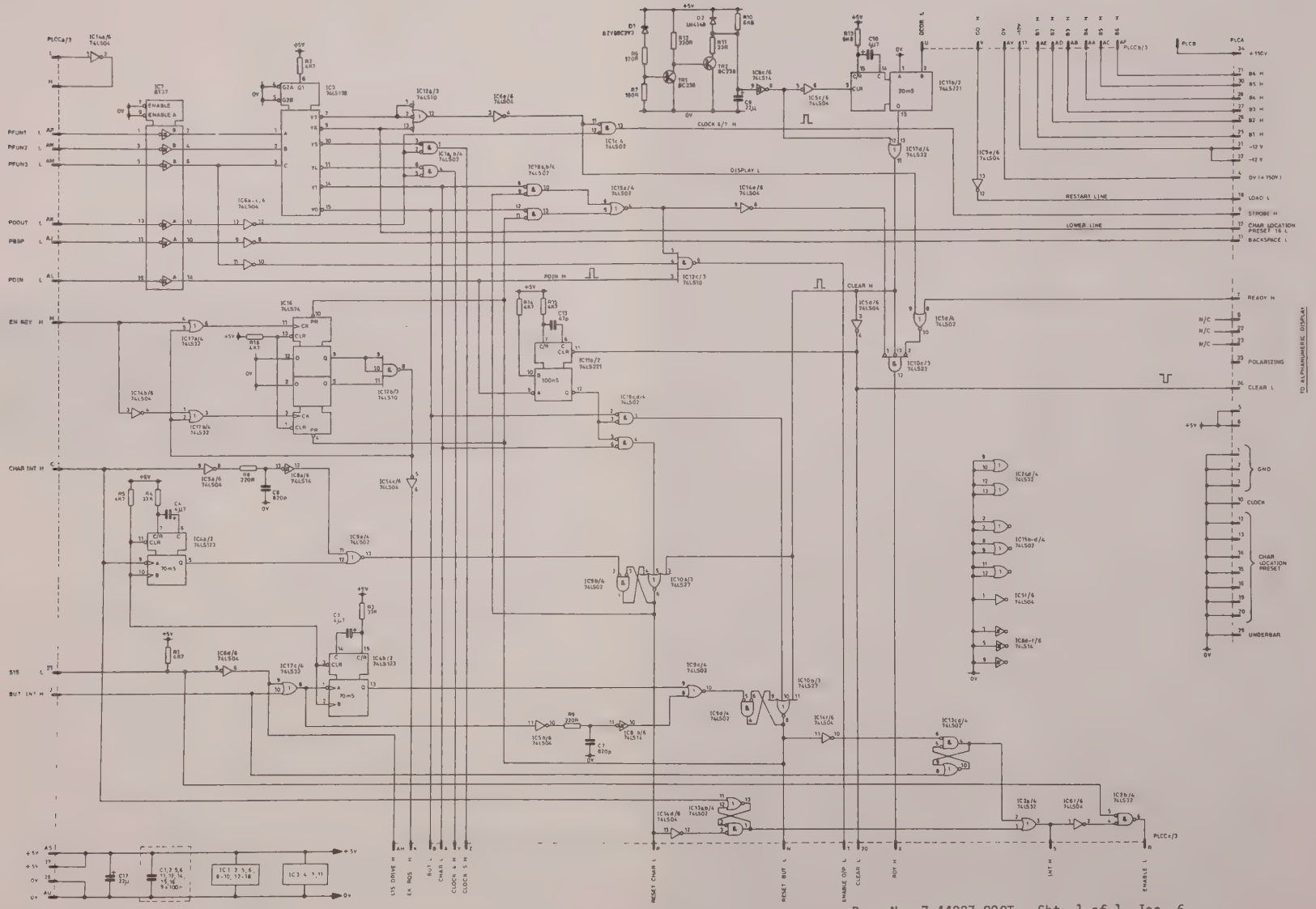



Fig. 5

Nov. 83 (Am. 6)

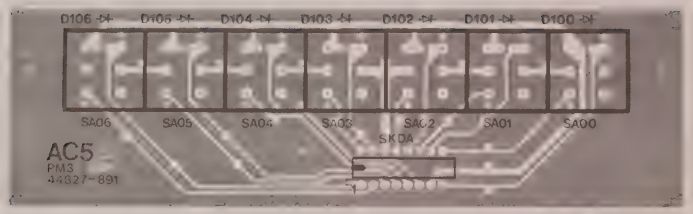
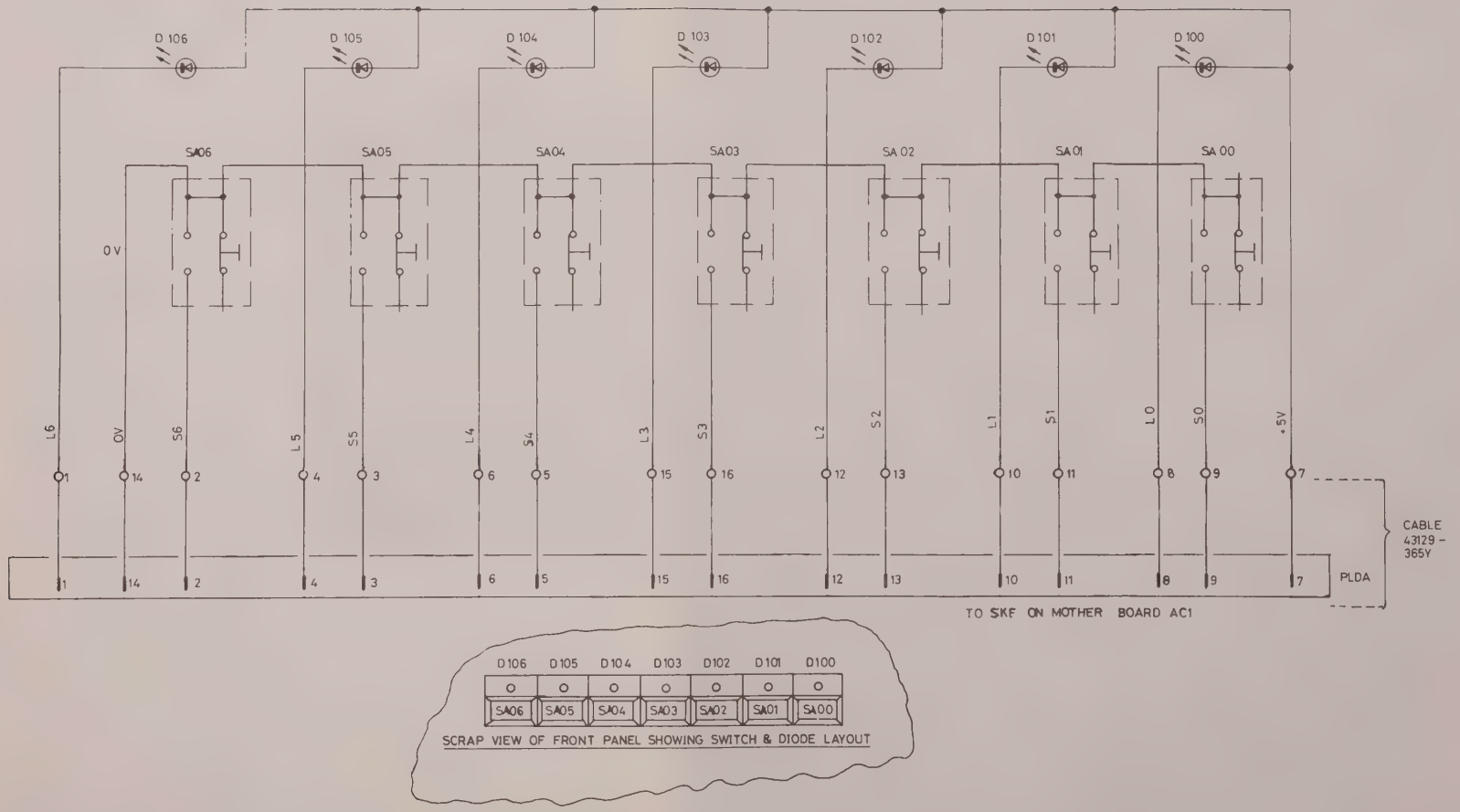



Fig. 6a Board AC5




Drg. No. Z 44827-891P Sht. 1 of 1, Iss. 2

Board AC5 : Switch board

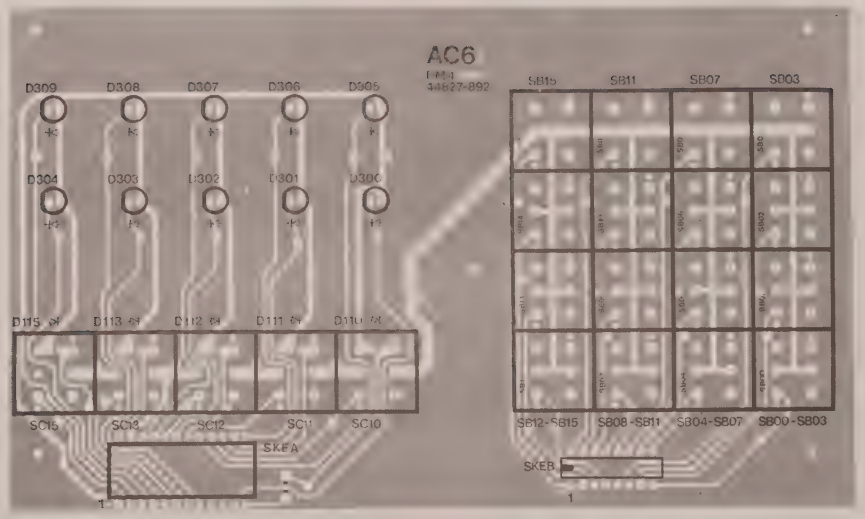
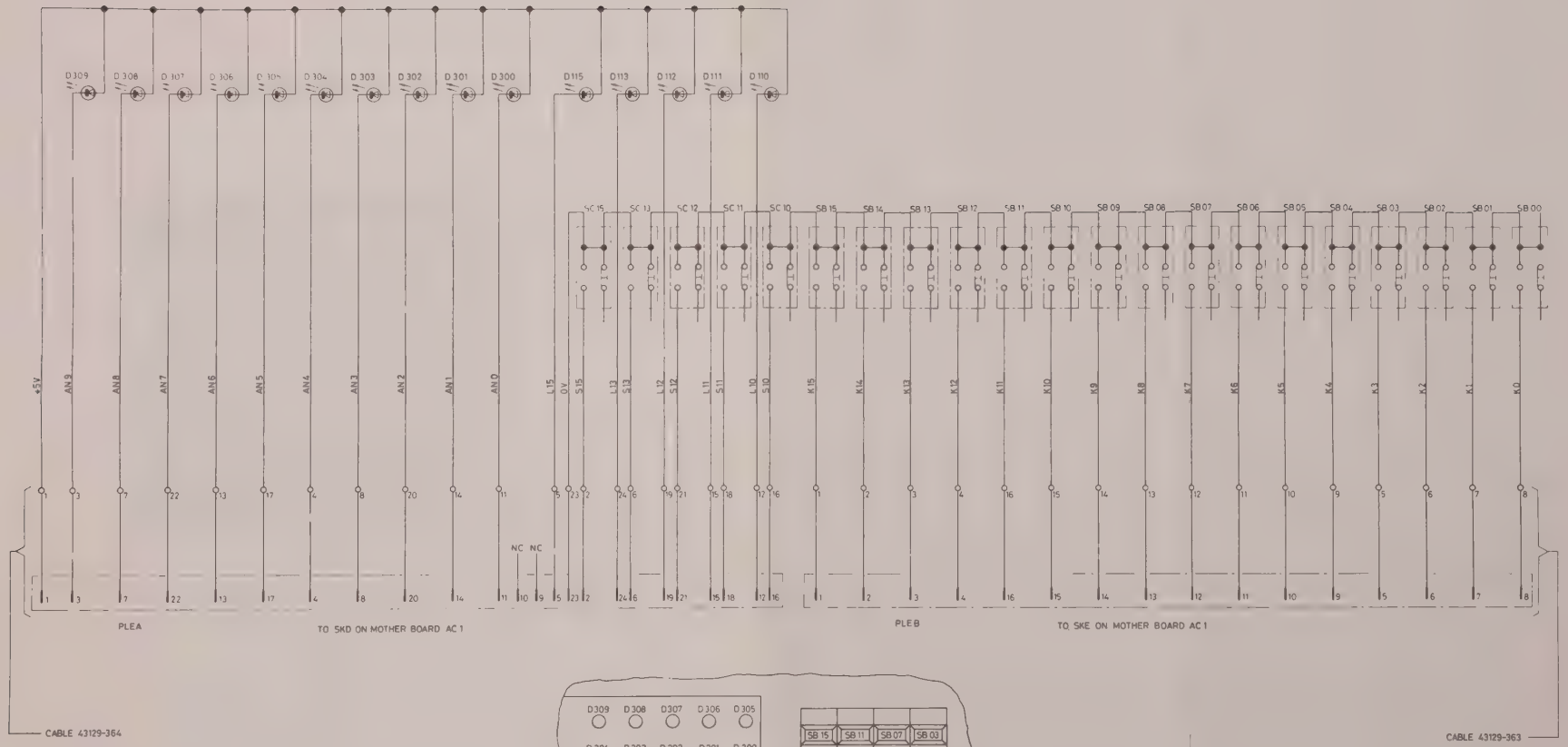
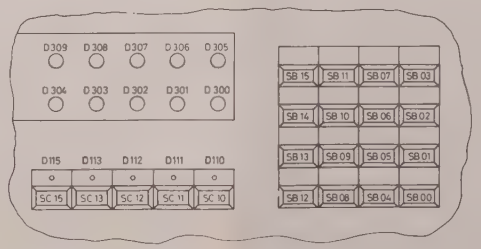



Fig. 7a Board AC6

Component layout


D309 D308 D307 D306 D305 D304 D303 D302 D301 D300 D115 D113 D112 D111 D110
SC15 SC13 SC12 SC11 SC10 SB15 SB14 SB13 SB12 SB11 SB10 SB09 SB08 SB07 SB06 SB05 SB04 SB03 SB02 SB01 SB00
+5V AN9 AN8 AN7 AN6 AN5 AN4 AN3 AN2 AN1 AN0 L15 0V S15 L13 S13 L12 S12 L11 S11 L10 S10 K15 K14 K13 K12 K11 K10 K9 K8 K7 K6 K5 K4 K3 K2 K1 K0
NC NC
PLEA
TO SKD ON MOTHER BOARD AC1
PLEB
TO SKE ON MOTHER BOARD AC1
CABLE 43129-364
CABLE 43129-363




SCRAP VIEW OF FRONT PANEL SHOWING SWITCH AND DIODE LAYOUT

Drg. No. Z 44827-892X Sht. 1 of 1, Iss. 2

Board AC6 : Input/output

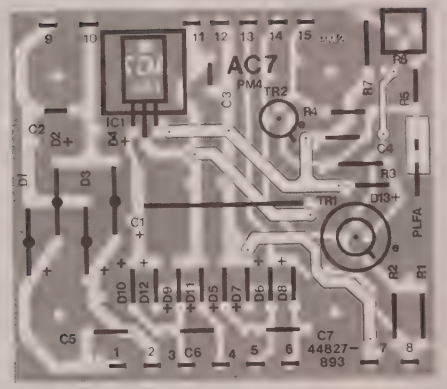
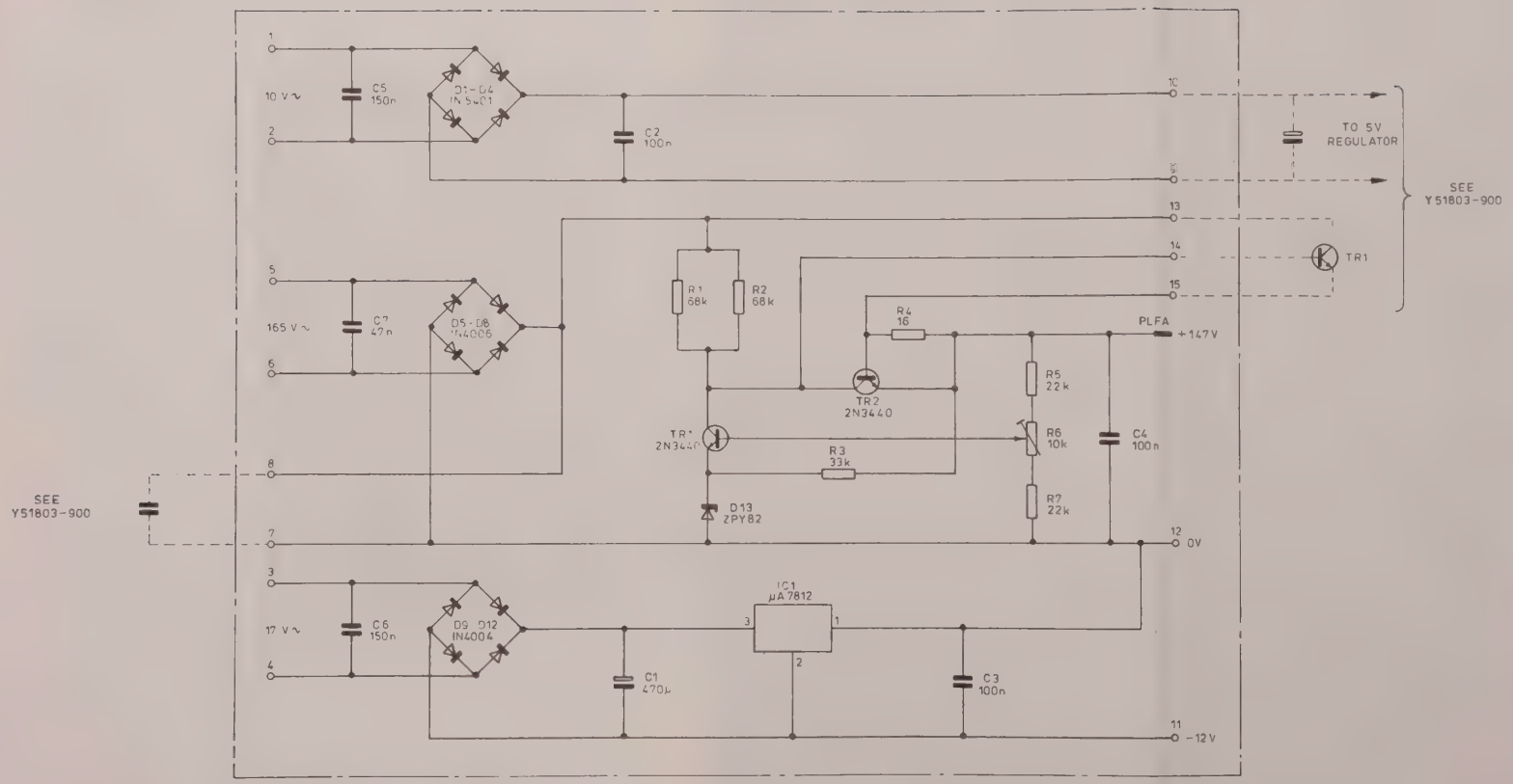



Fig. 8a Board AC7

Component layout




Drg. No. Z 44827-893M Sht. 1 of 1, Iss. 5

Board AC7 : Power supply

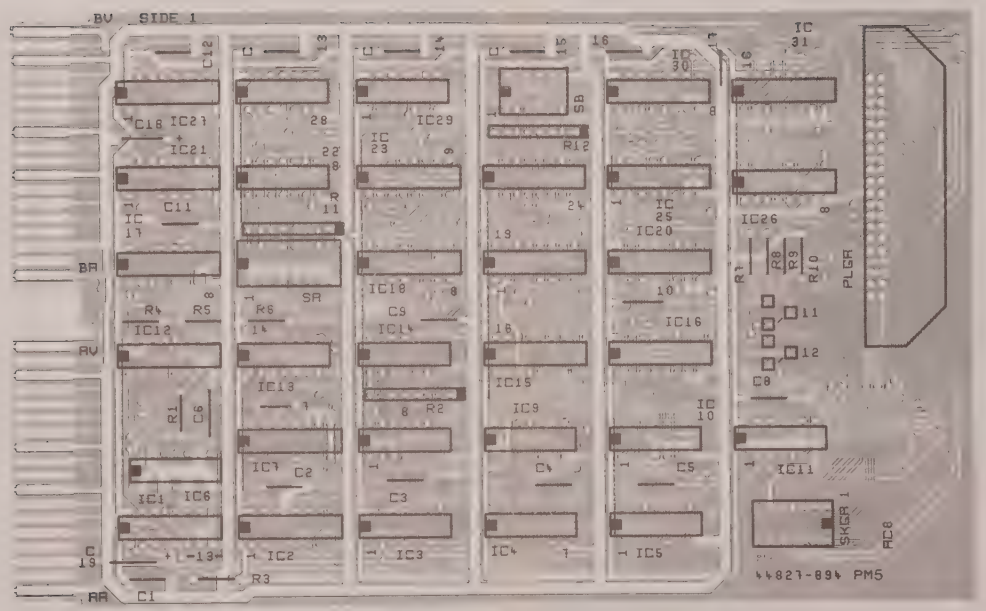
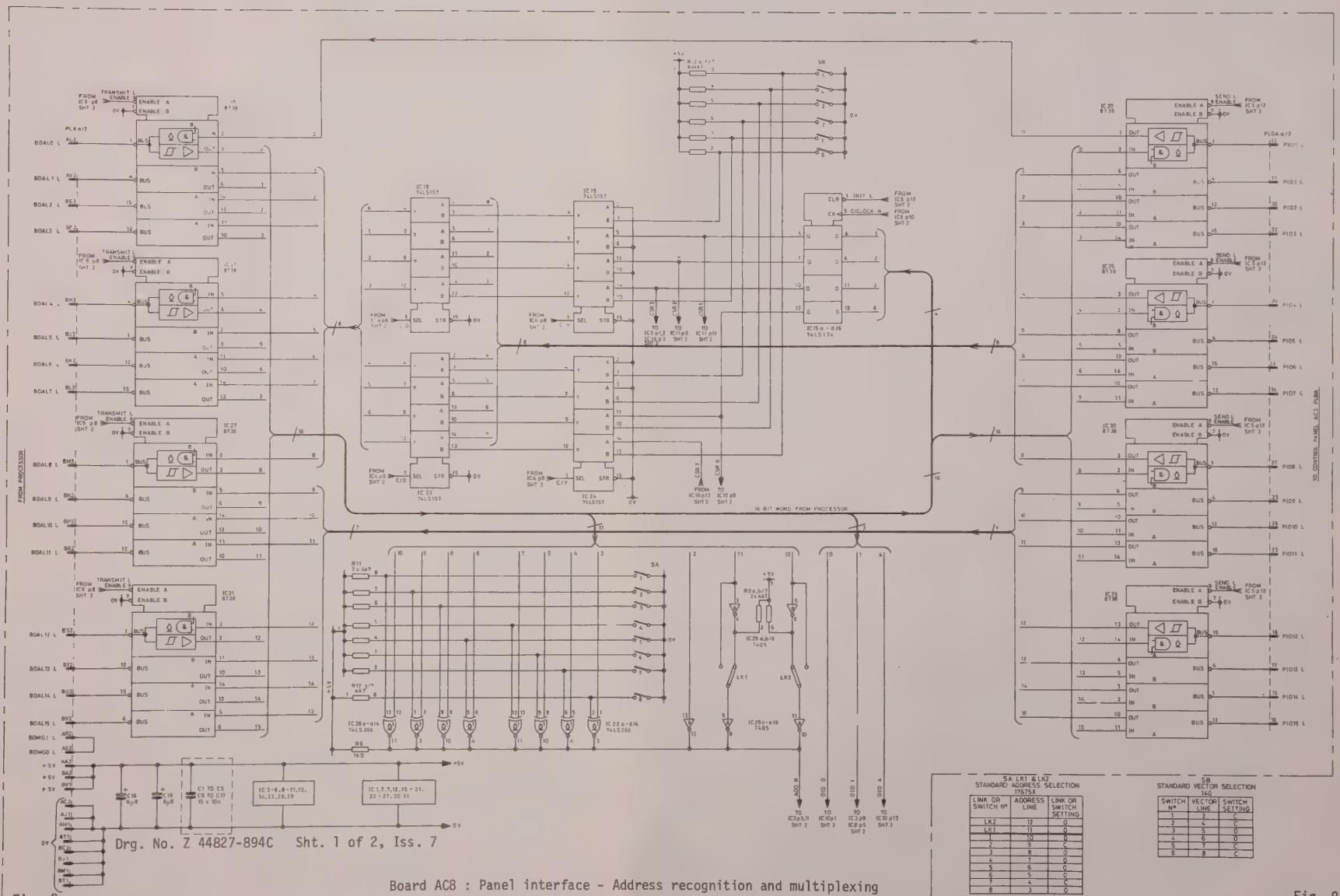



Fig. 3a Board AC8

Component layout




SA LK1 & LK2
STANDARD ADDRESS SELECTION
17675A

| LINK OR SWITCH Nº | ADDRESS LINE | LINK OR SWITCH SETTING |
|---|---|---|
| LK2 | 12 | 0 |
| LK1 | 11 | 0 |
| 1 | 10 | 0 |
| 2 | 9 | C |
| 3 | 8 | 0 |
| 4 | 7 | 0 |
| 5 | 6 | 0 |
| 6 | 5 | 0 |
| 7 | 4 | C |
| 8 | 3 | 0 |

SB
STANDARD VECTOR SELECTION
140

| SWITCH Nº | VECTOR LINE | SWITCH SETTING |
|---|---|---|
| 1 | 2 | C |
| 2 | 4 | C |
| 3 | 5 | 0 |
| 4 | 6 | 0 |
| 5 | 7 | C |
| 6 | 8 | C |

Board AC8 : Panel interface - Address recognition and multiplexing

Fig. 9
Jul. 83 (Am. 5)

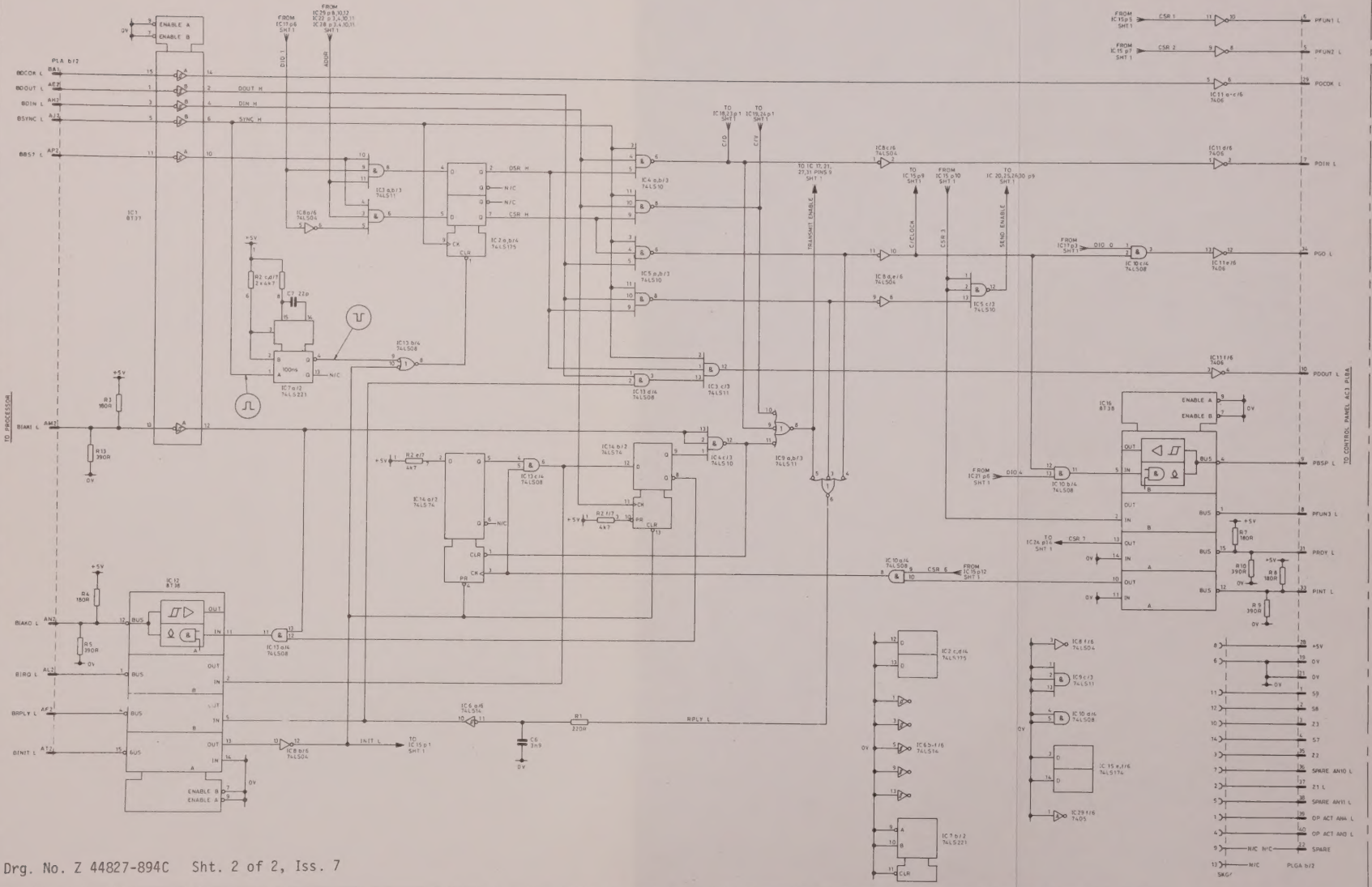



Fig. 10

Board AC8 : Panel interface - Control circuits

Jul. 83 (Am. 5)

## MARCONI INSTRUMENTS LIMITED

### UK

Marconi Instruments Limited
Longacres, St. Albans
Herts. AL4 0JN
Telephone: (0727) 59292
Telex: 23350
Fax: (0727) 57481

### FRANCE

Marconi Instruments France
18, Rue du Plessis-Briard "Le Canal"
91000 EVRY Courcouronnes
Telephone: (6) 077 9066
Telex: 690482
Fax: (6) 077 6922

### WEST GERMANY

Marconi Messtechnik G.m.b.H.
8034 Germering
Landsberger Strasse 65
Telephone: 8984 50 85
Telex: 5212642
Fax: 8984 19142

### USA

Marconi Instruments
Automatic Test Equipment Division
292 Gibraltar Drive, Building A2
Sunnyvale, CA 94089
Telephone: (408) 745-7561
Telex: 910 379 0001
Fax: (408) 734 5412

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